FISHERY MANAGEMENT INVESTIGATIONS

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FISHERY MANAGEMENT ANNUAL REPORT

Ed Schriever, Director

SOUTHWEST REGION - MCCALL
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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

HIGH MOUNTAIN LAKE SURVEYS

ABSTRACT

The McCall Subregion of the Idaho Department of Fish and Game (IDFG) surveyed six high mountain lakes (HMLs) in 2019. The primary purpose of visiting these lakes in 2019 was to tag fish for a HML exploitation evaluation study being conducted by Nampa Fisheries Research. In addition to tagging fish, we also determined species composition, relative abundance, and size structure of the fish communities in these lakes: Boulder Lake, Boulder Mountain Reservoir, Cly Lake #3-4, Corral Lake #1, Crater Lake, and Deep Lake. Fish were sampled at all HMLs except Boulder Lake. We sampled two fish at Boulder Meadows Reservoir. We sampled 50 fish in Cly Lake #3-4, and tagged a total of 37 fish. In Corral Lake, we sampled one tiger muskellunge *Esox masquinongy X E. lucius*, which was stocked in 2007. We did not capture any trout in Corral Lake, despite annual stocking of fingerlings since 2012. A gill net was left set over winter in Corral Lake in an attempt to remove any remaining tiger muskellunge in the lake, in an effort to improve stocked trout survival. We sampled 72 fish in Crater Lake #1 and tagged 50 fish. We sampled and tagged a total of four fish at Deep Lake. Exploitation data will be assessed by Nampa Fisheries Research staff at a later date. This survey information will help guide our HML management program, and helps identify the best use of stocking resources.

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INTRODUCTION

The McCall Subregion of the Idaho Department of Fish and Game (IDFG) surveyed five high mountain lakes (HMLs) in 2019. The primary purpose of visiting these lakes in 2019 was to tag fish for a HML exploitation evaluation study being conducted by Nampa Fisheries Research. In addition to tagging fish, we also used this opportunity to determine species composition, relative abundance, and size structure of the fish communities in these lakes: Boulder Lake, Cly Lake #3-4, Corral Lake #1, Crater Lake, and Deep Lake. Species composition, relative abundance, and size structure information is presented here, while exploitation evaluation will be carried out by Nampa Fisheries Research staff at a later date. This survey information guides our HML management program, and helps identify the best use of stocking resources.

OBJECTIVES

1. Tag trout (>100 mm) in a variety of HMLs to estimate exploitation (harvest) by anglers using the "Tag-You're-It Program".

2. Assess species composition, relative abundance, and size structure of the fish communities in lakes visited for exploitation tagging.

3. Determine if tiger muskellunge (hereafter, "tiger muskie"; Muskellunge *Esox masquinongy X* Northern Pike *E. lucius)* are still present in Corral Lake from stocking in 2007, and determine if annual stocking of fingerling trout since 2012 has been successful. Remove as many tiger muskie as possible if they are still present.

STUDY AREAS AND METHODS

We sampled fish at each lake with either hook-and-line, gill nets, or a combination of both. Gill nets were Swedish backpacking-style standard monofilament nets 36-m long by 1.8-m deep, and composed of six panels of 10.0-, 12.5-, 18.5-, 25.0-, 33.0-, and 38.0-mm mesh.

We tagged trout using T-bar anchor tags to estimated exploitation. All trout sampled >100 mm total length (TL) were tagged using a 70-mm (51 mm of tubing) fluorescent orange Floy® FD-68BC T-bar anchor tag. All anchor tags were labeled with "IDFG" and the tag reporting phone number (IDFG 1-866-258-0338) on one side, and the tag number on the reverse side. Anglers could report tags using the IDFG "Tag-You're-It" phone system and website (accessible at https://fishandgame.idaho.gov/feedback/fish/forms/reportTaggedFishAngler.cfm), as well as at regional IDFG offices and by mail.

All fish captured were identified to species, enumerated, measured (mm; TL), and weighed (g). Catch-per-unit-effort (CPUE) was calculated by dividing the number of fish caught by the number of hours fished. The presence and relative abundance of amphibians around the entire perimeter of the lake was assessed using a modification of the timed visual encounter survey (VES, Crump and Scott 1994).

Boulder Lake

Boulder Lake (44.87008°N, -115.94653°W) is a 31.6-ha lake that sits at 2,127 m in elevation in the North Fork of the Payette River drainage 13-km southeast of McCall. The lake is accessed from Boulder Meadows Reservoir via a well-defined 5.2-km trail. Alternately, the lake can be accessed via the more strenuous Louie Lake Loop Trail, which is a 10.9-km loop that begins south of Boulder Meadows Reservoir. There are dispersed camping opportunities at Boulder Lake, and the lake received heavy recreational use during summer months.

IDFG has stocked Boulder Lake since 1925 with Cutthroat Trout *Oncorhynchus clarkii a*nd Rainbow Trout *O. mykiss*. The lake has been stocked with approximately 1,000 Cutthroat Trout annually since 2014, however, it was not stocked in 2018. On August 6, 2019, we conducted a hook-and-line angling survey where two anglers fished each for 1.75 h.

Boulder Meadows Reservoir

Boulder Meadows Reservoir (44.867720°N, -115.966055°W) is a 124.2-ha lake that sits at 1,913-m in elevation in the North Fork of the Payette River drainage 13-km southeast of McCall. The reservoir is accessed via traveling 7.6-km east on Boulder Lake Road and sits directly off the road. There is a campground with vault toilets near the reservoir and the reservoir receives relatively high fishing pressure during summer months.

IDFG has stocked Boulder Lake since 1968 with Rainbow Trout and Cutthroat Trout. The lake has been stocked with approximately 3,000 catchable Rainbow Trout annually for the last decade.

We conducted a rod and reel angling survey on July 2, 2019 where four anglers fished for eight hours each. We also assessed the presence and relative abundance of amphibians around the entire perimeter of the lake using a modification of the timed VES.

Cly Lake #3-4

Cly Lake #3-4 (45.022126°N, -115.907734°W) is a 4.1-ha interconnected chain of two lakes that sits at 2,361-m in elevation in the South Fork Salmon River drainage, 25-km northeast of McCall. The lake is accessed from Lick Creek Summit. Access to Cly Lake #1 is cross-country, but a trampled user-trail can be found to reach Cly Lake #2, and eventually Cly Lake #3-4. There is one dispersed campsite and two fire pits at Cly Lake #3-4.

Cly Lake #3-4 is stocked by IDFG on a biennial basis with an average of 700 Cutthroat Trout for each event. Prior to 1994, Cly Lake #3 and #4 were stocked separately, but have since been stocked as a single lake, due to their interconnectedness. Cly Lake #3-4 likely sees relatively low fishing effort, due to remoteness and lack of a maintained trail.

We set a standard Swedish backpacking-style floating gill net and sinking gill net (pair) in Cly Lake #3-4 on July 1, 2019. Nets were left set overnight, for approximately 11 h. We also conducted hook-and-line angling surveys on the evening of July 1 and morning of July 2. This consisted of five people each angling for 4 hours in the evening and 1.5 hours in the morning. All fish captured were identified to species, enumerated, measured (mm; TL), and weighed (g). All captured fish greater than 100 mm TL were tagged using an orange T-bar anchor tag. Fish captured from the gill net were tagged only if they were deemed likely to survive and tagging would not decrease their chance of survival.

Corral Lake #1

Corral Lake (45.120655, -116.184233) is a 2.6-ha lake that sits at 2,087-m elevation, 23-km northeast of McCall in the Little Salmon River drainage. There is no trail to Corral Lake. The best way to access the lake is from Goose Lake Road, by travelling 3.0-km north of Goose Lake and proceeding 1.0-km to the west through intermittent forest with many downed trees. There are no campsites at Corral Lake.

IDFG has stocked Corral Lake since 1947 with Brook Trout *Salvelinus fontinalis,* Rainbow Trout, and Cutthroat Trout. As of the early 2000s, Brook Trout were the only species present. In 2007, the lake was stocked with tiger muskie as part of a research evaluation to determine their effectiveness for eradicating Brook Trout (Koenig et al. 2015). For the last decade, it has been stocked with 500 fingerling Rainbow Trout annually. Our objective in 2019 was to determine the trout species composition, and whether any tiger muskie were still present in the lake. According to Koenig et al. (2015), tiger muskie were successful at completely eradicating Brook Trout from Corral Lake within 2 years of stocking. No lake survey has been conducted at Corral Lake since 2012.

We set two standard sinking gill nets in Corral Lake on September 11, 2019. Nets were set overnight, for 24 h. We also conducted hook-and-line angling surveys consisting of three anglers fishing each for two hours. Captured tiger muskie were removed from the lake.

Crater Lake #1

Crater Lake #1 (45.044759, -115.429981) is a 4.6-ha lake that sits at 2,470-m elevation, 13-km northeast of Yellow Pine in the South Fork Salmon River drainage. Crater Lake is accessed from Big Creek Road via a single lane, two-track road at Ellison Creek. At the end of that road is a 2.4-km well-packed trail that leads to Crater Lake. Crater Lake is a unique alpine lake in that the majority of the land around the perimeter of the lake is privately owned, and there is a seasonal residence at the northeast end of the lake. However, the entire shoreline of the lake is still accessible to the public. There is one campsite with a fire pit near the lake.

IDFG has stocked Crater Lake since 1940 with Rainbow Trout and Cutthroat Trout. Since 1984 it has been stocked exclusively with Cutthroat Trout. For the last decade it has been stocked once every three years with 700 Cutthroat Trout.

We conducted a hook-and-line angling survey at Crater Lake on August 6, 2019. The survey consisted of two people each angling for 4.75 h in the evening and 5 h in the morning/afternoon.

Deep Lake

Deep Lake (45.16587, -115.93143) is a 12.7-ha lake that sits at 2,236-m elevation 32-km northeast of McCall in the North Fork Payette River drainage. Deep Lake is accessed from Warren Wagon Road by turning east down a single lane road at Cloochman Creek and proceeding 3.3-km. At the end of that road is a 1.3-km well-maintained trail that leads to Deep Lake. There are two campsites with fire pits near the lake.

Deep Lake has been stocked by IDFG since 1929 with Rainbow trout, Cutthroat Trout, and Brown Trout *Salmo trutta*. It was last stocked with around 850 Brown Trout in 1989 and has not been stocked since. We conducted a hook-and-line angling survey to see if any fish persisted in the lake. The survey consisted of two people each angling for 4.75 h on the afternoon of August 7, 2019.

RESULTS AND DISCUSSION

Boulder Lake

No fish were caught during the 3.5 combined hours of angling at Boulder Lake (CPUE = 0.0 fish/h). No amphibians were observed during the VES survey. The sampling crew noted an abundance of anglers and people recreating at the lake, despite the day being rainy and overcast, suggesting it is a popular destination. The current stocking rate of Boulder Lake is 32 fish/ha. Compared to lakes surveyed in 2019 where angling CPUE was high, this is a relatively low stocking density (Cly Lake #3-4 = 187 fish/ha and Crater Lake = 68 fish/ha). This is further compounded in that Boulder Lake is a popular fishing lake that is easy to access while Cly #3-4 and Crater Lake #1 are more remote and have less fishing effort. Future surveys at Boulder Lake should include gill netting to assess abundance and size structure of fish and to determine if a higher stocking density is necessary for this fishery.

Boulder Meadows Reservoir

Two Rainbow Trout were caught during the 32 combined hours of angling at Boulder Meadows Reservoir (CPUE = 0.1 fish/h). Both Rainbow Trout measured 175 mm in total length. Weights were not recorded. Two Western Toads *Anaxyrus boreas* were observed during the VES survey. Boulder Meadows was stocked with roughly 1,200 catchable-sized Rainbow Trout (i.e., > 150 mm) on June 19, just 13 days prior to sampling the reservoir, so it is surprising that so few fish were captured with the large effort that was made. The crew additionally noted several fisherman, who expressed frustration at catch rates being poor. In the future, exploitation tags should be released in catchable Rainbow Trout to estimate return to creel, and when that harvest is occurring relative to stocking events.

Cly Lake #3-4

We sampled a total of 50 fish in gill nets and through angling surveys in Cly Lake #3-4 in 2019 (96% Cutthroat Trout and 4% Rainbow Trout). We captured 22 fish during 22 hours of gill netting (CPUE = 1.0 fish/h) and 28 fish in 27.5 hours of combined angling (CPUE = 1.0 fish/h; Table 1). Cutthroat Trout length ranged from 209 to 385 mm, and averaged 311.5 mm (*n* = 48; Figure 1). Rainbow Trout length ranged from 250 to 300 mm, averaging 275.0 (*n* = 2; Table 2). No weights were obtained from fish at Cly Lake #3-4. The presence of Rainbow Trout in Cly #3-4 provides evidence of natural reproduction, since no Rainbow Trout have been stocked in this lake since 1977. We deployed a total of 37 exploitation tags in fish, and this data will be summarized at a later date by the Nampa Fisheries Research staff. By analyzing the exploitation rate of fish in Cly Lake #3-4, we will be able to better understand angler-use and harvest in remote, difficult to access alpine lakes such as this one.

Corral Lake

No fish were captured during 24 hours of gill netting or 6 hours of combined angling (CPUE = 0.0 fish/h) in Corral Lake in 2019. One tiger muskie was observed and hand-netted in a weedy patch. The tiger muskie measured 666 mm in length and weighed more than the maximum capacity of the scale (1,500 g).

Tiger muskie appear to be preying upon Rainbow Trout that have been stocked annually in the lake since 2012, as no evidence of trout survival was found during our survey. Trout are stocked as fingerlings (mean = 150 mm), thus are highly susceptible to predation by large predatory fish. In an effort to remove all remaining tiger muskie, and improve survival of stocked trout, a 92 m gillnet (114 mm stretched mesh) was left set over winter in Corral Lake. The net will be retrieved immediately after ice-off in 2020. Surplus triploid Cutthroat Trout fingerlings were available at the McCall Fish Hatchery in fall, 2019, and 4,870 of those fish were stocked in Corral Lake at a very high density (1,873 fish/ha) in October, 2019. Cutthroat Trout will continue to be stocked in this lake after removal of tiger muskie in an effort to reestablish a trout fishery.

Crater Lake #1

We sampled a total of 72 fish during a combined 19.5 hours of angling in Crater Lake #1 in 2019 (75% Rainbow Trout x Cutthroat Trout hybrids, 15% Cutthroat Trout, and 10% Rainbow Trout; CPUE = 1.8 fish/h). Hybrids ranged in length from 143 to 245 mm, and averaged 225 mm (n = 54; Table 2), and relative weights averaged 62 and ranged from 33 to 85 (Figure 1). Cutthroat Trout length ranged from 200 to 267 mm, and averaged 237.3 mm (n = 11; Table 2), and relative weights averaged 68 and ranged from 58 to 77 (Figure 2). Rainbow Trout length ranged from 185 to 246 mm, averaging 275 (n = 7; Table 2), and relative weights averaged 66 and ranged from 60 to 79 (Figure 2). We deployed a total of 50 exploitation tags in fish, and this data will be summarized at a later date by the Nampa Fisheries Research staff. By analyzing the exploitation rate of fish in Crater Lake #1, we will be able to better understand angler-use and harvest in remote, but fairly easily accessible lakes such as this one.

Deep Lake

We sampled a total of four Brook Trout during the 9.5 hours of combined angling at Deep Lake (CPUE = 0.4 fish/h). No other species were caught. Brook Trout length ranged from 205 to 235 mm, with a mean length of 218.8 mm (Table 2). Exploitation tags were implanted in all captured fish. Future surveys of Deep Lake should include gill nets and exploitation tags to evaluate relative abundance and size structure, and estimate angler-use.

MANAGEMENT RECOMMENDATIONS

1. Continue to estimate trout exploitation in a wide variety of HMLs with differing characteristics (lake size, species, use, and remoteness) to gain understanding of this important metric..

2. Assess current status of tiger muskie in Corral Lake based on catch in an overwinter gill net set. Work to remove remaining tiger muskellunge and continue stocking with Cutthroat Trout to re-establish a fishery.

3. Tag catchable-sized trout prior to stocking in Boulder Lake to estimate return-to-creel and longevity. Conduct gill net survey at Boulder Lake to determine if stocking density is sufficient for the amount of fishing effort it receives.

4. Use gill nets to collect comprehensive size structure and catch rate data from Deep Lake and consider options to improve catch rates and size structure.

5. Discontinue or reduce stocking densities in Crater Lake #1 due to evidence of natural reproduction, high catch rates, and low relative weight.

LOWLAND LAKE SURVEYS

ABSTRACT

The McCall Subregion surveyed Granite Reservoir, Herrick Reservoir, Lost Valley Reservoir, Horsethief Reservoir, and Little Payette Lake in 2019 to determine fish species composition, relative abundance, and size structure. All lakes were surveyed using floating and sinking gill nets. Granite Reservoir was also monitored with backpack electrofishing and a shoreline survey. At Granite Reservoir we captured a total of 32 fish (78% Rainbow Trout *Oncorhynchus mykiss*, 3% Brook Trout *Salvelinus fontinalis*, 19% Redside Shiner *Richardsonius balteatus*). The field crew also reported seeing highlyconcentrated schools of Redside Shiner while walking the shoreline. At Herrick Reservoir, we captured 167 fish (62% Yellow Perch Perca flavescens and 37% Rainbow Trout). Catch rates and size structure at Herrick Reservoir suggested potential for a quality fishery, though it is probably under-utilized. At Lost Valley Reservoir we captured a total of 81 fish (74% Yellow Perch, 26% Rainbow Trout). Perch and trout in Lost Valley Reservoir were small in size and low in relative weight. To improve growth rates, IDFG has been working with irrigators to draw-down the reservoir in the fall to reduce Yellow Perch abundance. This strategy appears to be more effective than chemical eradication. At Horsethief Reservoir, we sampled a total of 177 fish (55% Rainbow Trout, 29% Brown Trout, 12% Black Bullhead, and 4% kokanee salmon). The fish sampled at Horsethief Reservoir had high relative weights, suggesting adequate forage quality and stocking densities, currently. At Little Payette Lake we captured a total of 116 fish (57% Northern Pikeminnow *Ptychocheilus oregonensis*, 32% Largescale Sucker *Catostomus macrocheilus*, 5% Smallmouth Bass *Micropterus dolomieu*, 3% kokanee salmon, 2% Mountain Whitefish *Prosopium williamsoni*, and <1% tiger muskellunge *Esox masquinongy* x *E. Lucius*). We recommend transplanting Smallmouth Bass into Little Payette in 2020. The information gathered from these surveys helps fishery managers prioritize efforts that are likely to increase benefits to anglers.

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INTRODUCTION

The McCall Subregion of the Idaho Department of Fish and Game (IDFG) surveyed four lowland lakes and reservoirs in 2019 to determine composition, relative abundance, and size structure of the fish communities. A lowland lake/reservoir is defined as those accessible by road and able to be stocked directly by a truck (excluding ‘community ponds’). The McCall Subregion manages 17 lentic waterbodies that fit this criteria. The waterbodies surveyed in 2019 were Granite Reservoir, Herrick Reservoir, Lost Valley Reservoir, Horsethief Reservoir, and Little Payette Lake. All of these waterbodies are managed as put-and-take fisheries, where IDFG stocks catchable-sized fish (typically >250 mm). Horsethief Reservoir and Little Payette Lake are also managed as a put-and-grow fishery, with fingerling stocking occurring annually. The information gathered from these surveys, along with angler effort, catch, and opinion surveys, helps IDFG prioritize management efforts that are most likely to provide benefit to anglers.

OBJECTIVES

1. Conduct inventories on regional lowland lakes and reservoirs to determine current fisheries status and develop management recommendations to increase fishery quality

STUDY AREAS AND METHODS

Granite Lake

Granite Lake (45.104252°N, -116.075444°W) is a 75.9-ha subalpine reservoir that sits at an elevation of 2,058-m in the North Fork Payette River drainage, 22-km north of McCall. The East Fork of Lake Creek forms the inlet and outlet of Granite Reservoir, which joins Fisher Creek before draining into the North Fork of the Payette River. The Payette National Forest maintains several dispersed camping areas with vault-toilets, fire rings, and picnic tables at Granite Reservoir.

Granite Lake is managed as a put-and-take trout fishery, and has been stocked by IDFG since 1925. On average, approximately 4,000 catchable-size (mean 250 mm TL) Rainbow Trout have been stocked each year, since 2011. The most prevalent species sampled in past surveys were Rainbow Trout *Oncorhynchus mykiss*, Brook Trout *S. fontinalis*, and Redside Shiner *Richardsonius balteatus*. Although Rainbow Trout have been the most frequently stocked species, Golden Trout *O. mykiss aguabontia*, Arctic Grayling *Thymallus arcticus*, Westslope Cutthroat Trout *O. clarkii*, and splake *Salvelinus frontinalis x S. namaycush* have also been stocked in the past. Splake were stocked in 1992 in an attempt to convert Redside Shiner biomass to sportfish biomass, and provide increased sportfishing opportunity for anglers.

We set two pairs of standard experimental gill nets (46 m x 2 m with six panels consisting of 19-, 25-, 32-, 38-, 51-, and 64-mm bar mesh; one sinking net and one floating net per pair) on August 26, 2019 to determine species composition and size structure of the fish community. One pair of nets was placed immediately off-shore while the other was set in open water. Nets were set overnight; hours were not recorded, so effort is expressed as net-nights. All fish captured were identified to species, enumerated, measured (mm TL), and weighed (g).

Fish were visually examined for obvious parasites or maladies. Additionally, a shoreline study was performed by walking the perimeter of the lake and noting the habitat and biota observed.

Backpack electrofishing was conducted at the inlet of Granite Reservoir on August 27, 2019 to evaluate the abundance of Redside Shiner. The entirety of the inlet that was available to be shocked was sampled, from the first riffle upstream until the water was too shallow or the stream was completely dry. All parts of the inlet were shocked including the underside of banks, logs, rocks, and other obstacles. Shock time was not recorded.

Herrick Reservoir

Herrick Reservoir (44.374068°N, -115.984049°W) is 14.9-ha in size and sits at 1,488-m of elevation in the North Fork of the Payette River drainage. Herrick Reservoir is accessed via Herrick Lane, south of Cascade. Complete driving distance from Cascade is approximately 18.5-km with the latter 2.5-km on a well-maintained gravel road. The reservoir is managed as a put-and-take fishery and has been stocked by IDFG since 1953. Rainbow Trout have been exclusively stocked during that time, except for two stocking events of Cutthroat Trout in 1976 and Coho Salmon *O. kisutch* in 1972. For the past decade, an average of 5,300 catchable Rainbow Trout have been stocked annually.

We set one standard sinking gill net in Herrick Reservoir overnight on September 23, 2019 to determine species composition and size structure of the fish community. The net was attached to shore and stretched out to the middle of the lake. Netting effort was not recorded. All fish captured were identified to species, enumerated, measured (mm TL), and weighed (g). Fish were visually examined for obvious parasites or maladies.

Lost Valley Reservoir

Lost Valley Reservoir (44.964726°N, -116.463787°W) is 211.4-ha in size and sits at 1,460-m elevation in the Weiser River drainage. Lost Valley Reservoir is one of four irrigation reservoirs in the Weiser River drainage built by private irrigation districts. It is generally filled during spring runoff and then drawn down to low water levels in the summer and early fall. In extremely dry years, the reservoir has gone dry (IDFG 2019). Lost Valley Reservoir can be accessed by traveling 26-km north from Council to the community of Pine Ridge and traveling west on Lost Valley Reservoir Road for 6.5-km. There are numerous dispersed camping areas and vault-toilets around the reservoir. Additionally, there is a dock and motor boat launch area along the South-West shore of the reservoir.

Lost Valley Reservoir is managed as a put-and-take Rainbow Trout fishery, but has a history of problems associated with stunted Yellow Perch *Perca flavescens*. When the Yellow Perch population increases to the point that it results in increased competition and reduced growth rates for both trout and perch, the reservoir has routinely been drawn-down and chemically restored (IDFG 2019). IDFG has stocked the reservoir since 1922 with Rainbow Trout, splake, Cutthroat x Rainbow Trout hybrids, and fall Chinook Salmon *O. tshawytscha*; Rainbow Trout have been stocked exclusively since 1997.

We set two pairs of standard gill nets (one floating and one sinking per pair) on August 26, 2019 to determine species composition, relative abundance, and size structure of the fish community. One pair of nets was placed immediately off-shore while the other was set in open water. Nets were set overnight; hours were not recorded, so effort is expressed as net-nights. All fish captured were identified to species, enumerated, measured (mm TL), and weighed (g). Fish were visually examined for obvious parasites or maladies.

Horsethief Reservoir

Horsethief Reservoir (44.509904°N, -115.915870°W) is 104.6-ha in size and sits at 1,539-m elevation east of Cascade in the Payette River drainage. Horsethief Reservoir sees relatively high fishing effort throughout the entire year, both in open water and during the ice fishery. The reservoir is accessed by traveling east from Cascade on Warm Lake Highway and proceeding 5-km south on Horsethief Reservoir Road.

Horsethief Reservoir and much of the land around it is owned by IDFG. There are six large campgrounds around the reservoir that are owned by IDFG, but are managed by the Treasure Valley YMCA through a cooperative MOU. The primary purpose of the reservoir is to provide a recreational fishery. As such, the reservoir has been stocked by IDFG since 1968, and is currently managed as a put-and-take/put-and-grow fishery. The reservoir has been stocked with splake and Cutthroat x Rainbow Trout hybrids in past years, but has been stocked more consistently with Rainbow Trout (25,000 catchable; 12,500 subcatchable), Brown Trout *Salmo trutta* (13,000 fingerlings) and kokanee salmon *O. nerka* (3,000 fingerlings) on an annual basis since 2001. Horsethief Reservoir had the highest angler exploitation in the McCall Subregion with an average of 18.3% of stocked Rainbow Trout harvested in the last three years of exploitation tagging data. A year-round creel survey in 1994 estimated 78,900 angler hours were spent at Horsethief Reservoir and 39,721 fish were harvested (Janssen et al. 2000).

We set two pairs of standard gill nets (one floating and one sinking per pair) on September 8, 2019. One pair was set close to shore, and the other in open water. Nets were set overnight and removed after approximately 24 h. All fish captured were identified to species, enumerated, measured (mm TL), and weighed (g).

Little Payette Lake

Little Payette Lake (44.917975° N, -116.035232° W) is a 582.4-ha lake that sits at 1,561-m elevation in the North Fork Payette River drainage, 2-km east of McCall. Little Payette Lake is accessed via Lick Creek Road, a well-maintained road. The lake has historically been a put-and-take Rainbow Trout fishery, however, large numbers of nongame fishes compete with and prey on Rainbow Trout and diminish their survival. As such, angling pressure on Little Payette has dropped to near zero as trout survival and angler success has diminished. The lake was chemically treated in 1987 to remove nongame species and angler use greatly increased. By 1993 however, nongame biomass again exceeded game fish biomass (Janssen et al. 2007). Currently, the lake functions primarily as a Smallmouth Bass *Micropterus dolomieu* fishery. In order to maintain this fishery, Smallmouth Bass are transplanted from Oxbow and Hells Canyon Reservoirs every 3 to 5 years. Additionally, tiger muskellunge (Muskellunge *Esox masquinongy* x Northern Pike *E. Lucius)* are stocked annually. Little Payette Lake currently holds the world record for tiger muskellunge; at 20 kg, caught in 2013. For the last decade, Smallmouth Bass have been stocked six times, averaging 600 fish greater than 150 mm transplanted at each event. Tiger muskellunge have been stocked five times in the last decade, averaging 650 stocked at each event, and Rainbow Trout have not been stocked since 2012.

We set two pairs of standard gill nets (one floating and one sinking per pair) on September 26, 2019 to determine species composition and size structure of the fish community in Little Payette Lake. One pair of nets was placed immediately off shore while the other was set in open water. Nets were left set overnight; hours were not recorded, so effort is expressed as net-nights. All fish captured were identified to species, enumerated, measured (mm TL), and weighed (g). Fish were visually examined for obvious parasites or maladies.

RESULTS AND DISCUSSION

Granite Reservoir

We sampled a total of 32 fish by gill netting and electrofishing in Granite Reservoir in 2019 (78% Rainbow Trout, 3% Brook Trout, 19% Redside Shiner). Gill netting CPUE was 8.0 fish per net-night; 70% of gill netted fish were caught in the pair of nets set in open water (versus shoreline). Rainbow Trout (n = 25; CPUE = 6.3 fish per net-night) ranged from 233 to 386 mm with a mean length of 274 mm (Table 3; Figure 3). Rainbow Trout relative weight averaged 74 and ranged from 62 to 88 (Figure 3). The single Brook Trout captured was 206 mm and had a relative weight of 93 (Figure 3).

We captured six Redside Shiner while backpack electrofishing the inlet. These fish ranged from 38 to 102 mm with a mean length of 83 mm. Redside Shiner fry were also observed in high abundance near the inlet and outlet and in the shallow areas of the lake, but were difficult to capture. The field crew anecdotally noted observing “thousands of shiner fry in large schools”. Although Redside Shiners are highly abundant, our methods were not effective to capture a large number of them.

Stocked Rainbow Trout (catchables) are the primary component of the fishery in Granite Reservoir. However, Redside Shiner are presumably the most abundant species. Redside Shiner are somewhat of a nuisance to anglers in Granite Reservoir for two reasons: they take angler bait intended for Rainbow Trout, and they can compete for resources and negatively impact growth rates of stocked Rainbow Trout (Johannes and Larkin, 1961). In 1992, splake were stocked in to Granite Reservoir to convert shiner biomass to a more desirable form– sportfish biomass. Results were not thoroughly evaluated and splake have not been detected since 1996, but previous data suggests they did not grow exceptionally large. As such, to accomplish the same goal, a different sterile predator is recommended, such as tiger trout (*S. fontinalis x S. trutta).*

Our objective is to utilize the shiner biomass as a food source for tiger trout, to improve the fishery in three ways: 1) tiger trout can consume shiner and grow appreciably large, and could therefore convert shiner biomass into a form that is more desirable to anglers, 2) reducing Redside Shiner biomass through predation may improve the Rainbow Trout fishery by reducing competition and allowing for increased growth rates, and 3) stocking tiger trout would diversify fishing opportunity in the area (there are currently no tiger trout in the McCall subregion). In Wallace Lake, Idaho, tiger trout have been stocked annually since 2015 to accomplish identical objectives. Results of fishery surveys at Wallace Lake have shown significant annual reductions in abundance of Redside Shiner, concurrent with increases in angling effort since before tiger trout were introduced (Messner and Schoby, 2019). Although there is anecdotal evidence that a small number of tiger trout have grown appreciably large as a result of consuming shiner, the majority did not. This is likely because tiger trout are so aggressive that they are readily harvested by anglers, and are not given enough time to reach large sizes. At Wallace Lake, the immediate 3-fold increase in angler effort and subsequent high exploitation rates for tiger trout may have hindered their ability to reside in the lake for a long enough duration to grow appreciably. In order to improve effectiveness of our objectives, it is recommended to not widely advertise the introduction of tiger trout into Granite Reservoir. If tiger trout are stocked in Granite Reservoir, it will be prudent to monitor whether the desired results are accomplished.

Herrick Reservoir

We sampled a total of 167 fish (63% Yellow Perch and 37% Rainbow Trout) in Herrick Reservoir in 2019, for a combined CPUE of 167.0 fish per net-night. Yellow Perch (n = 105; CPUE = 105.0 fish per net-night) ranged in length from 119 to 345 mm (mean 235.6 mm; Table 3), and relative weights averaged 55 with a range of 16 to 67 (Figure 4). Rainbow Trout (n = 62; CPUE = 62.0 fish per net-night) ranged from 136 to 355 mm in length (mean 255 mm; Table 3), and relative weights averaged 80 and ranged 46 to 119 (Figure 4). All Yellow Perch and Rainbow Trout captured during this survey appeared to be in good physical condition.

Based on the number and sizes of sport fish captured in our survey, Herrick Reservoir has the potential to provide excellent fishing opportunities for anglers. Length-frequency distributions showed an abundance of Yellow Perch in the 200-230 mm (~8-9 inch) range and Rainbow Trout in the 240-260 mm (9.5-10.5 inch) range (Figure 4). Although we have not evaluated angler effort at this reservoir, we speculate that this fishery is underutilized by anglers. Much of the surrounding area is privately owned by DF Development, who restrict public access. The majority of the public doesn't understand how to access the reservoir or where the public access area is. This becomes apparent when searching the internet for Herrick Reservoir and reading reviews on popular fishing and outdoor websites. Putting this reservoir on one of the blog posts recommending easy fishing areas to the public that comes out each summer, and explaining how to access the reservoir and where the public land is, would help promote this quality fishing opportunity.

Lost Valley Reservoir

We sampled a total of 84 fish in Lost Valley Reservoir in 2019 (71% Yellow Perch and 29% Rainbow Trout) for a combined CPUE of 21.0 fish per net-night. Yellow Perch (n = 60; CPUE = 15.0 fish per net-night) ranged in length from 100 to 265 mm (mean = 171.5 mm; Table 3) and relative weights averaged 47 with a range of 39 to 63 (Figure 5). Rainbow Trout (n = 21; CPUE = 5.3 fish per net-night) ranged in length from 275 to 375 mm (mean = 326.3 mm; Table 3) and relative weights averaged 80 with a range of 72 to 89 (Figure 5). All Yellow Perch and Rainbow Trout captured during this survey appeared to be in good physical condition.

An objective listed in the 2019-2024 Statewide Fisheries Management Plan is to maintain a 0.5 to 1.0 fish/h catch rate of 12- to 16-inch Rainbow Trout in Lost Valley Reservoir. This objective stems from the fact that the Rainbow Trout fishery in Lost Valley Reservoir has long been negatively influenced by stunted Yellow Perch abundance, which has resulted in poor Rainbow Trout catch rates in some years. We have found that our ability to maintain a quality put-and-take/put-and-grow Rainbow Trout fishery in Lost Valley Reservoir depends on our ability to reduce Yellow Perch abundance. Historically, chemical treatments were used approximately every 5 to 7 years in order to reduce Yellow Perch abundance. However, we have recently learned that draw-down of the reservoir can be just as effective to achieve similar results. In some years the reservoir is drawn-down significantly, which results in poor overwinter survival of perch - keeping perch biomass (thus competition with stocked trout) relatively low. In 2010, prior to chemical treatment in 2012, exploitation was estimated between 15-40% (Koenig 2012) indicating the reservoir is capable of producing a quality trout fishery in some years. Chemical treatment has not occurred since 2012, and in recent years we have been assessing angler exploitation rates for stocked Rainbow Trout to determine whether fall draw-down is sufficient (in lieu of chemical treatment) for increasing Rainbow Trout exploitation and catch rates. In 2019, exploitation remained relatively high (17.4%), however, no surveys were conducted to directly assess catch rate. Future surveys should include angling for Rainbow Trout, creel census to assess catch rates, or both, to understand if the catch rate outlined in the management plan is being achieved.

Horsethief Reservoir

We sampled a total of 177 fish at Horsethief Reservoir in 2019 (55% Rainbow Trout, 29% Brown Trout, 12% Black Bullhead, and 4% kokanee salmon). Rainbow Trout (*n* = 97; CPUE = 44.3 fish per net-night) ranged in length from 150 to 388 mm (mean = 255 mm; Table 3) and relative weights averaged 90 with a range of 66 to 115 (Figure 6). Brown Trout (*n* = 51; CPUE = 12.8 fish per net-night) ranged from 174 to 366 mm (mean = 298 mm; Table 3) and relative weights averaged 89 with a range of 63 to 112 (Figure 6). Black Bullhead *Ameiurus melas* (*n* = 21; CPUE = 5.3 fish per net-night) ranged from 177 to 305 mm (mean =233 mm; Table 3) and relative weights averaged 81 with a range of 56 to 113. Kokanee salmon (*n* = 8; CPUE = 2.0 fish per net-night) ranged from 231 to 371 mm (mean = 323 mm; Table 3) and relative weights averaged 91 with a range of 84 to 97 (Figure 6). All fishes captured during this survey appeared to be in good physical condition.

Rainbow Trout were the most abundant species caught during our survey, and we know these fish are well-utilized by anglers at Horsethief Reservoir (three year mean exploitation rate = 18.3%). Kokanee salmon were first stocked in Horsethief Reservoir in 2016, and have been stocked annually since that time. Based on our survey results in 2019, kokanee appear to be growing well (mean relative weight = 91; maximum TL = 371 mm) and show potential to add additional diversity to the salmonid fishery. Brown Trout fingerlings have been stocked annually since 2007. In the future, an effort should be made to tag Brown Trout for exploitation analysis and conduct angler surveys to evaluate kokanee catch rates. Although Brown Trout were the second most abundant fish encountered during our surveys, we have never conducted an evaluation of Brown Trout use and exploitation in Horsethief Reservoir using the Tag-Your-It program. Awareness of the presence of kokanee salmon and Brown Trout in the reservoir by anglers and the desire to catch them seems to be high; however, anecdotally, catch rates for both species appear to be relatively low. By utilizing angler surveys and the Tag-You're-It program, we can better understand exploitation and catch rates for all species in the reservoir and use that information to guide our stocking.

The appearance of Black Bullhead in our catch indicates the previous rotenone removal project in 2015 was unsuccessful. Black Bullhead populations can compete with trout for food resources and target angler's baits and lures, impacting catch rates and reducing angler satisfaction. Although Black Bullhead persist in Horsethief Reservoir, return-to-creel rates of Rainbow Trout remain relatively high (18.3%). Therefore, future surveys should include trap nets or gill-nets to closely monitor Black Bullhead relative abundance and size structure. If return-to-creel rates, condition, or relative abundance of Rainbow Trout decrease in the future while Black Bullhead relative abundance increases, managers should consider restoration efforts to remove Black Bullhead.

Little Payette Lake

We sampled a total of 116 fish at Little Payette Lake in 2019 (57% Northern Pikeminnow *Ptychocheilus oregonensis*, 32% Largescale Sucker *Catostomus macrocheilus*, 5% Smallmouth Bass, 3% kokanee salmon, 2% Mountain Whitefish *Prosopium williamsoni*, and <1% tiger muskellunge). Northern Pikeminnow (*n* = 66; CPUE = 16.5 fish per net-night) ranged in length from 195 to 564 mm (mean = 374 mm; Table 3; Figure 7). Largescale Sucker (*n* = 37; CPUE = 9.3 fish per net-night) ranged from 270 to 600 mm (mean = 521 mm; Table 3; Figure 7). Smallmouth Bass (*n* = 6; CPUE = 1.5 fish per net-night) ranged from 180 to 470 mm (mean = 403 mm; Table 3) and relative weights averaged 84 with a range of 76 to 98 (Figure 8). Kokanee salmon (*n* = 4; CPUE = 1.0 fish per net-night) ranged from 197 to 219 mm (mean = 206 mm; Table 3) and relative weights averaged 73 with a range of 67 to 76 (Figure 8). Mountain Whitefish (*n* = 2; CPUE = 0.5 fish per net-night) ranged from 376 to 395 mm (mean = 386 mm; Table 3) and relative weights averaged 125 with a range of 120 to 131 (Figure 8). The single tiger muskellunge captured (CPUE = 0.3 fish per net-night) was 930 mm (Table 3) with a relative weight of 137. All fishes captured during this survey appeared to be in good physical condition.

Few Smallmouth Bass were captured in Little Payette Lake in 2019, though the average size and relative weights was high. Smallmouth Bass have not been transplanted into Little Payette Lake since 2017, despite being stocked annually most prior years. We recommend transplanting Smallmouth Bass from Oxbow Reservoir in 2020.

MANAGEMENT RECOMMENDATIONS

1. Stock Granite Reservoir with a predatory sport fish capable of converting Redside Shiner biomass into sport fish biomass. Evaluate use/exploitation and angler effort.

2. Use angling and/or creel surveys at Lost Valley Reservoir to determine if the 0.5 to 1.0 fish per hour catch rate outlined in the fisheries management plan is being achieved.

3. Tag Brown Trout in Horsethief Reservoir and utilize the Tag-You're-It program to better understand exploitation.

4. Conduct angler surveys on Horsethief Reservoir to assess catch rates of kokanee salmon and evaluate stocking densities.

5. Monitor trends in Black Bullhead relative abundance and compare with Rainbow Trout condition and exploitation to determine if and when management actions are required to reduce the Black Bullhead population.

6. Transplant Smallmouth Bass to Little Payette Lake from Oxbow Reservoir in 2020.

LAKE CASCADE ANNUAL FALL GILL-NETTING SURVEY

ABSTRACT

Annual gill-netting surveys are conducted in Lake Cascade each October to monitor changes in abundance and size structure of the fish community. Previous work at Lake Cascade suggests that an increase in the abundance of large (>350 mm TL) Northern Pikeminnow *Ptychocheilus oregonensis* (NPM) can have significant negative impacts on the Yellow Perch *Perca flavescens* and Rainbow Trout *Oncorhynchus mykiss* fishery. Therefore, these surveys help managers determine if and when management intervention (i.e. rotenone application or manual removal) is needed to reduce NPM abundance to improve fishery quality. In 2019, 1,274 fish of 13 species were captured. Yellow Perch composed 15.2% of the total catch (n = 194), Rainbow Trout composed 6.6% of the catch (n = 85), and Smallmouth Bass *Micropterus dolomieu* composed 6.3% (n = 80). Black Bullhead *Ameirus melas,* NPM, and Largescale Sucker *Catastomus macrocheilus* composed 28.4% (n = 362), 17.8% (n = 227), and 17.7% (n = 226) of the catch, respectively. Yellow Perch caught in 2019 ranged in age from 0 to 15 years. Abundance and size structure of Yellow Perch and NPM in 2019 were similar to 2018 and 2017 results. Mean number of fish caught per pair of gill nets in 2019 (catch per site; ± 90% CI) for Yellow Perch was 13 (± 4), with an average of 8 (± 2.5) greater than 250 mm, and mean catch per site for all NPM was 15 (± 6), with an average of 4 (± 2.5) greater than 350 mm. These results suggest no immediate management intervention is needed to reduce NPM abundance in Lake Cascade.

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INTRODUCTION

Lake Cascade has a long history of fishery management activities dating back to 1958; only ten years after the dam was erected and the reservoir was formed. Since the early years of the fishery, biologists have found that the quality of the sport fishery in Lake Cascade (primarily Yellow Perch *Perca flavescens* (hereafter referred to as perch), and to a lesser extent Rainbow Trout *Oncorhynchus mykiss,* kokanee *Oncorhynchus nerka*, and bass *Micropterus spp.*) is negatively affected by Northern Pikeminnow *Ptychocheilus oregonensis* (NPM) abundance. This is thought to be caused by predation on young sport fish by NPM. Chemical treatments of NPM spawning tributaries in 1958-1962 and 1968-1974 removed a total of 825,000 and 428,500 NPM, respectively (Bennett, 2004). Subsequently, the quality of the sport fishery (trout and perch) increased substantially. Angler effort reportedly increased from approximately 129,000 hours in 1972, to 400,000 hours by 1980, with perch making up over 70% of angler harvest.

Throughout the 1980s and into the early 1990s, the sport fishery at Lake Cascade was extremely popular. Despite a sharp decline in perch abundance in the mid-1990s, Lake Cascade was ranked ninth in Idaho for angler hours and fish landed in 1996 (IDEQ 1996). However, due to low recruitment of perch in the lake beginning around 1990, the perch fishery collapsed by the early 2000s. This collapse in the early 2000s resulted in a sharp decline in angler effort, and a loss of approximately $6 million in terms of the overall annual economic value of the fishery (Bennett, 2004). Again, this collapse was found to be caused by high predation rates by NPM. Biologists suggested that a NPM population dominated by fish greater than 350 mm and a marked decline or absence of juvenile perch could predict a pending decline in the quality of the perch fishery (Allen et al. 2009).

From 2004-2006, biologists implemented another large-scale restoration effort at Lake Cascade, which included removing nearly 30,000 NPM and stocking over 860,000 perch transplanted from Phillips Reservoir near Sumpter, OR and Lost Valley Reservoir near Pineridge, ID (Janssen et al. 2008). The quality of the sport fishery again improved in the lake, and by 2011, IDFG estimated the economic value of the fishery increased to $11 million (IDFG - unpublished data). Since 2014, Lake Cascade has produced three state record perch, and two world record perch.

Since perch restoration efforts were completed, fisheries management objectives in Lake Cascade have primarily been focused on monitoring changes in perch and NPM abundance and size (length) structure, in order to determine when further NPM suppression efforts will be necessary to maintain high fishery quality. Objectives listed in the IDFG 2019-2024 Fisheries Management Plan (IDFG 2018) specify that adult NPM abundance should be aggressively reduced if mean catch per site of NPM greater than 350 mm reaches or exceeds 10, or the percent of NPM greater than 350 mm caught during fall gill-netting reaches or exceeds 75%.

Gill-netting surveys are conducted every October in Lake Cascade to monitor changes in abundance and size structure of the fish community. Since 2012, these surveys have been standardized to occur on or near the same dates, at the same sites, with the same amount of effort and gear type.

OBJECTIVES

1. Monitor relative abundance and size structure of the NPM community in order to determine whether suppression efforts are needed in the near future to reduce predation on perch and trout.

2. Monitor sport fish relative abundance, size structure, and condition to assess current fishery quality and guide future management strategies.

METHODS

We sampled 15 gill net sites from September 30 through October 3, 2019. These sites are described in Janssen et al. (2014). Each site was sampled once, each with one pair (one floating and one sinking) of IDFG standard experimental gill nets (each 46 m x 2 m, with six panels consisting of 19-, 25-, 32-, 38-, 51-, and 64-mm bar mesh). At shoreline sites, sinking gill nets were attached to shore. The exception was in very shallow, low slope bottom areas, where nets were set in at least one meter of water. Also at shoreline sites, the floating net was set in a minimum of three meters deep water, as close to the shoreline set as possible. Nets were fished overnight and pulled the next day, and catch per unit effort (CPUE = mean number of fish per pair of gill nets at a site; ± 90% confidence intervals) was calculated to compare relative abundance with previous years. Significant differences in catch rates between years are determined to be those which 90% confidence intervals do not overlap.

All fish were identified and measured for total length (nearest mm) and a subsample of five (5) of each 10-mm length group were weighed. Length-frequency histograms were built for each species to show size structure of fish sampled, and we calculated proportional stock density (PSD-Q) and incremental relative stock densities (RSD) for perch (130-mm stock length and 200 mm quality length) and Smallmouth Bass *Micropterus dolomieu* (180 mm stock length and 300 mm quality length) to compare size structure with previous years. We also used length and weight data to calculate mean relative weights (W_r) for each species, except hatchery Rainbow Trout where condition factor was calculated to determine body condition and compare with previous years.

Yellow Perch and Smallmouth Bass operculums were collected from up to five (5) of each 10-mm length group. Operculums were placed in paper envelopes and allowed to dry to prevent decay before being prepared for ageing. Operculums were placed in boiling water for approximately 60 seconds, removed, and the skin was immediately removed with a small, stiff bristle brush. Operculums were then air dried completely to turn the operculums opague, making annuli visible. Operculums were then aged using a 10x power dissecting scope.

Yellow Perch ages from two through six (aligned with aged operculums in 2019) were applied to length frequencies from 2012 through 2019 fall trend sampling. Annual mean catch for the highest 10-mm length group for each specific age class was used to develop age class catch curves. These catch curves were used to determine relative survival rates between age/length classes among years.

RESULTS

During standard fall gill-netting in October, 2019, we caught 1,274 fish of 13 species in Lake Cascade (Table 4). Perch composed 15.2% of the total catch (*n* = 194), Rainbow Trout composed 6.6% of the catch (*n* = 85), and Smallmouth Bass composed 6.3% (*n* = 80). Northern Pikeminnow (NPM), Largescale Sucker *Catostomus macrocheilus,* and Black Bullhead *Ameiurus melas* composed 17.8% (*n* = 227), 17.7% (*n* = 226), and 28.4% (*n* = 362) of the catch, respectively. We also captured a relatively small number of Mountain Whitefish *Prosopium williamsoni* (*n* = 35; 2.8%), kokanee salmon (*n* = 42; 3.3%), Largemouth Bass *Micropterus salmoides* (*n* = 2; 0.2%), and Pumpkinseed *Lepomis gibbosus* (*n* = 15; 1.2%). Relative length-frequency of fish caught, by species, are shown in Figure 9.

Mean CPUE (± 90% C.I.) for Yellow Perch in 2019 was 13 (± 4), with an average of 8 (± 2.5) greater than 250 mm (Table 5). Since 2012, when standardized monitoring began, mean CPUE for Yellow Perch has ranged from 12 to 49, and averaged 27 (Figure 10). Mean CPUE of Yellow Perch greater than 250 mm has averaged 13.5 (range: 7 to 19; Figure 11). Mean CPUE values for all Yellow Perch, and Yellow Perch greater than 250 mm, in 2019 were virtually the same as the last two years, which were the lowest values observed since the most recent restoration project was completed from 2004 to 2006. Mean proportion of perch greater than 250 mm per site in 2019 was 59% (Table 5). That value has ranged 28% to 66% since 2012, and averaged 53%.

Mean proportion of Yellow Perch greater than 250 mm per site has increased in recent years as a result of relatively lower numbers of small perch caught (Figure 12). Mean length of perch in 2019 was 280 mm (Table 4, Figure 12) and mean relative weight was 89. PSD-Q for perch in 2019 was 80, and RSD-250, RSD-300, and RSD-380 were 59, 48, and 3, respectively (Table 6). PSD-Q and RSD values were all relatively average when compared with our trend dataset from 2012 to present. We aged a total of 160 Yellow Perch from 32 to 392 mm with ages from 0 to 15 years (Figure 13).

Mean CPUE for all NPM was 15 (± 6), with an average of 4 (± 2.5) greater than 350 mm (Table 5). Since 2012, mean CPUE for all NPM has ranged from 9 to 23, and averaged 17 (Figure 15), and mean CPUE of NPM greater than 350 mm has ranged 4 to 8, and averaged 5.5 (Figure 16). The percentage of NPM caught greater than 350 mm in 2019 was 29% which is relatively low when compared to our dataset from 2012 to present, which has ranged 24% to 47%, and averaged 34%. NPM mean length was 318 mm and ranged 125 mm to 552 mm (Table 4). Length frequencies are presented in Figure 17.

We collected 85 Rainbow Trout in 2019, of which 36 appeared to be of natural origin (Table 4). Natural origin Rainbow Trout ranged in length from 168 to 585 mm with a mean of 420 mm (Figure 18), and a mean condition factor of 0.98. Hatchery Rainbow Trout ranged in length from 273 mm to 535 mm, with a mean condition factor of 1.10. Mean length of spring 2019 stocked fish was 324 mm. Of the 49 hatchery fish collected, 20 were holdovers (>400 mm) from last spring and previous years stockings. Holdover hatchery Rainbow Trout ranged in length from 405 to 535 mm and averaged 441 mm (Table 7, Figure 18). We completed the 2019 survey before fall catchables were stocked.

We collected 80 Smallmouth Bass in 2019 that ranged in length from 152 to 506 mm with a mean relative weight of 97.2 (Table 4. PSD-Q, RSD-400, and RSD-800 was 87, 37 and 6 respectively. Mean catch rate per site was 5 (±3) fish/net pair (Table 8). We aged 29 fish from 290 to 506 mm at 3 to 15 years old (Figure 19).

Black Bullhead mean catch per site increased in 2019 to 24.1 (± 19), from an average of 8.1 over the past six years, although this difference was not significant due to high variability in catch per site in 2019. Largescale Sucker mean catch per site in 2019 was 15.1 (± 4.2) which is only slightly below the previous six year average (16.6).

DISCUSSION

Mean CPUE for perch in 2019 was similar to the previous two years (2018 and 2017). However, mean CPUE in these last three years is significantly lower than in all other years since standardized monitoring began in 2012. It is unclear if angler catch rates have been affected, because representative index creel surveys have not been conducted since 2016, and snow and ice conditions that year were not conducive to ice fishing, which contributes a relatively large proportion of annual fishing effort. However, we assume that mean CPUE values would correspond similarly to angler catch rates, thus angler catch rates are likely declining (anecdotally this seems to be the case). We have been observing this declining trend in perch catch rates since 2013. This is likely caused by a lack of significant recruitment past age-4 in recent years, as evidenced by length-frequency histograms and catch curves constructed annually. As the oldest age classes are dying off, fewer perch are replacing them, causing an overall declining trend in CPUE.

Mean 2019 CPUE for perch greater than 250 mm was virtually the same as 2018, which are among the lowest values observed since standardized monitoring began in 2012. Mean CPUE for perch greater than 250 mm in these last two years (2018 and 2019) was significantly lower than in 2012, and 2014 through 2016. Once again, as the top-end of the age structure is subjected to mortality (whether it be fishing or natural mortality), they are not being replaced at an equal rate. PSD-Q was higher in 2019, and incremental relative stock densities (RSD-250, RSD-300, and RSD-380) were slightly higher compared to 2018, again suggesting a lack of adequate recruitment of younger perch into the fishery, especially when taken into context with declining overall catch rates and declining catch rates of perch greater than 250 mm. This indicates a shift in size structure toward larger perch, which is concerning as those larger/older perch are subjected to mortality. However, anecdotally, anglers in 2019 reported catching more smaller-size perch than in previous years. It is plausible that our gill nets are not effective at accurately depicting true size structure of the perch population, due to net selectivity. It would be beneficial to develop a standard creel monitoring program for the fishery to be completed routinely every few years (including capturing size structure of angler catch) to understand how perch fishing is changing in Lake Cascade. Developing such a program will help provide more insight into whether management action is required to improve fishing conditions.

The observed decline in overall perch abundance since 2014, and consistent percentage of fish over 300 mm over the last four years was anticipated. Changes in perch size distribution from 2013 to 2019 and steep declines in survival rates of fish less than 200 mm indicate lower recruitment of fish greater than 250 mm in recent years. Large, long-lived perch (up to 15 years) has kept percentages of large perch high. Although it is not a standard metric we have been using to evaluate the perch fishery in Lake Cascade, trend analysis for percent of perch greater than 350 mm per site since 2013 shows a steady increase (Table 5). This, once again, suggests a lack of adequate juvenile recruitment and a perch population dominated by larger, old-aged fish.

Our catch curves are based on estimated ages (two to six) from operculums and length frequencies and indicate that once perch reach approximately age-4 (or 250 mm), annual mortality rates drop to nearly zero. This means survival rates of younger perch (age-0 through age-3) will have a large, long-term impact on the status of the fishery. Previous studies suggest mortality rates are highest on age-0, age-1 (Bennett 2004) and likely age-2 perch in Lake Cascade. At the time of Bennett's studies, perch numbers were severely depressed with virtually no age-2 perch present in the lake. High predation rates have likely been occurring on juvenile perch for the past decade in Lake Cascade, which will likely contribute to relatively poorer size structure of the perch population for some years to come; that is, until predation rates on juvenile perch are reduced. Prior to 2012, we routinely sampled young perch (age-0 through age-1) via trawls during spring, summer, and fall. However, these trawling surveys were discontinued as large numbers of age-0 perch did not result in higher recruitment of age-3 and greater fish, due in part, to predation by large perch, NPM and birds. However, as numbers of large perch decline and predation on age-0 and age-1 perch declines, re-establishing trawling surveys on an annual basis might help provide insight into the future quality of the perch fishery in Lake Cascade.

NPM predation on juvenile perch is considered a substantial factor of the status of the Cascade perch fishery, and requires continuous monitoring and population reduction measures when indicated (Allen et al. 2009). The IDFG Fisheries Management Plan specifies that adult Northern Pikeminnow abundance should be aggressively reduced if mean CPUE of NPM greater than 350 mm reaches or exceeds 10, or the percent of NPM caught greater than 350 mm reaches or exceeds 75% during fall gill-netting (IDFG 2018). Mean CPUE for all NPM in 2019 was slightly higher than in 2017 and 2018, but has not differed significantly since 2012. Mean CPUE of NPM greater than 350 mm did not change from 2016 through 2019, and was also not significantly different from any of the previous years. However, the percent of NPM caught greater than 350 mm was slightly higher in 2019 than three of the past four years (2015 was the last year in which rotenone treatment to reduce spawning NPM was completed). NPM abundance trends require annual monitoring to determine whether suppression is warranted.

Overall NPM catch rates and catch rates of NPM greater than 350 mm are still well below the objectives outlined in the IDFG Fisheries Management Plan (IDFG 2018). However, perch abundance has declined over the past several years, and if perch recruitment does not increase in the near future, rotenone treatment in NPM spawning tributaries of pre-spawn fish should be considered. In addition to treating the major NPM spawning tributary (North Fork Payette River), rotenone treatment in the other two large tributaries (Lake Fork Creek and Gold Fork River) will help provide further benefit to overall fishery quality. These rotenone treatments are relatively inexpensive and require relatively little logistical effort, and ultimately provide added benefit to the future status of the entire sport fishery in Lake Cascade. Treating these three tributaries for several years to suppress multiple generations of NPM in the lake should also be considered, as benefits to the sport fishery may last longer (Bennett 2004). Chemical treatments in several tributaries over consecutive years in the 1950s, 1960s, and 1970s, targeting both spawning NPM adults and emerging NPM fry, were very successful at improving juvenile perch and trout survival and improving the overall quality of the fishery.

Low survival and recruitment of juvenile perch over the past several years in Lake Cascade could also be, at least partially, attributed to cannibalism. Lake Cascade has been dominated by large numbers of perch greater than 250 mm for several years. Low mortality rates, abundant food resources, and low predation rates after the initial stocking of over 860,000 perch in 2004 through 2006 contributed to high survival to adulthood, which led to increased production of juveniles in 2009, 2010, and 2011. High survival of those 2009, 2010, and 2011 cohorts likely contributed to the abundance of large perch we've documented over the past several years. Although these cohorts have significantly increased the quality of the fishery today, their continued high abundance over the past several years has likely contributed to decreased juvenile perch survival through predation. This is evident in the lack of recruitment that has followed behind the 2009, 2010, and 2011 cohorts of perch. Anecdotal evidence shows that the gut contents of large perch caught by anglers in Lake Cascade are frequently dominated by juvenile perch. As the number of perch greater than 250 mm declines, we expect predation on small perch to decline and anticipate increased survival of juvenile perch, with 2-3 strong cohorts over the next 2-3 years.

Avian predation on juvenile perch by Western Grebe *Aechmophorus occidentalis* and American White Pelicans *Pelecanus erythrorhynchos* could potentially be a factor in Lake Cascade. Western grebes have been documented to consume perch up to 200 mm (Ydenberg and Forbes 1988) and counts in recent years have been relatively high. Mean Western Grebe counts from 2005 through 2019 were 3,147 and ranged from 1,900 to 4,980. The count in 2019 was among the highest (IDFG unpublished data; Figure 20). At this time, we are unsure if piscivorous birds are affecting perch recruitment substantially. Western Grebe diet studies could be beneficial in helping to develop this understanding.

Rainbow Trout are, and have historically been, an important sport fishery in Lake Cascade. In a 1991 to 1992 creel survey, Janssen et al. (1994) estimated over 43,000 Rainbow Trout were caught in Lake Cascade. Gill net catch for hatchery Rainbow Trout varies greatly from year to year, which is likely due to time of stocking relative to time of gill-netting; therefore, relative mean catch has little meaning. Since 2015, we have been stocking larger, "magnum" (mean TL 300 mm) Rainbow Trout in an attempt to increase survival. However, we have not observed an increase in holdover fish in our surveys since 2015. We currently stock approximately 100,000 hatchery Rainbow Trout in Lake Cascade annually, and exploitation evaluations suggest less than 10% of those fish currently return-to-creel within their first year-at-large (Cassinelli et al. 2016). Natural origin fish make up a significant portion of this fishery, and have been documented up to 745 mm TL in the reservoir. In late fall, natural-origin Rainbow Trout in Lake Cascade ascend the North Fork Payette River and overwinter, then continue to ascend as high as the city of McCall to spawn in spring. These adfluvial fish, likely the result of past steelhead and steelhead x domestic Rainbow Trout fingerling stockings, have become prized by local anglers and offer a unique opportunity for the area. In 2016, fishing regulations were changed on the section of the North Fork Payette River between Lake Cascade and Payette Lake, from general bag limits to catch and release, from December 1 through the Friday before Memorial Day weekend to protect this unique resource. Further investigations should be conducted to learn more about this adfluvial component of the fishery, with emphasis on determining if and how productivity can be increased. Increased productivity of this population has the potential to increase fishery quality for both the seasonal stream fishery in the North Fork Payette River, as well as in Lake Cascade during the open-water and ice fisheries.

While bass are an important component of the sport fishery at Lake Cascade, gill-netting and electrofishing catches and CPUEs are not good indices of Smallmouth Bass population structure or abundance in Lake Cascade. Water conductivity is very low (15-20 µS), so electrofishing is not effective, and gill nets are typically not set in ideal bass habitat due to logistical constraints. Several bass fishing tournaments are held annually at Lake Cascade, increasing the economic value of this fishery. There were eight bass club tournaments in 2019, of which Smallmouth Bass made up the majority of the catch, with an occasional Largemouth Bass. Exploitation tagging investigations, in addition to monitoring growth by collecting ageing structures during annual netting surveys, may be the best option for identifying trends in the bass population over time in the reservoir.

MANAGEMENT RECOMMENDATIONS

1. Develop a standardized annual creel survey program for Lake Cascade to study trends in angler catch over time.

2. Continue annual monitoring of perch and NPM populations as well as other fish species through fall gill-netting surveys. Use this data to determine when NPM population reduction efforts are needed to protect the perch fishery and enhance other sport fish populations.

3. Develop a graduate student study to evaluate major sources of predation on juvenile perch (up to 200 mm).

4. Continue stocking “magnum”-sized hatchery Rainbow Trout, and periodically evaluate return-to-creel of those fish.

5. Develop a study to learn more about movement and life history of natural-origin Rainbow Trout in the reservoir.

6. Compile bass population trend data over time by evaluating exploitation from tagging studies and growth from ageing structures collected during annual surveys.

7. Compare precision of age estimates from operculums and otoliths for perch and Smallmouth Bass to inform future evaluations of population structure.

LAKE CASCADE JUVENILE YELLOW PERCH TRAWLING SURVEY

ABSTRACT

A bottom trawl was utilized from 1998 through 2010 to monitor changes in juvenile Yellow Perch population structure and abundance. The trawl was effective in monitoring changes in population size and survival of juvenile Age-1 and 2 yellow perch. The trawl sampling effort was completed again in 2019 at 9 of the 21 historical sites established in 1998. We captured a total of 9,226 perch, the majority (9,192) of which were Age-0.

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INTRODUCTION

A bottom trawl was utilized from 1998 through 2010 to monitor changes in Yellow Perch population structure and abundance. The trawl was effective in monitoring changes in population size and survival of young-of-year and yearling perch. Ideally, trawl catch of juvenile perch would identify strong age classes and therefore predict age class strength of harvestable-size perch. However, past trawl catch of juvenile perch was not a good indicator of recruitment of large perch in years to follow. This was presumed to be the result of predation on juvenile perch by large numbers of perch greater than 250 mm present in the lake. Currently with the decline in numbers of large perch over the last three years, juvenile perch numbers may now be a better indicator of age class strengths that persist and recruit into the future fishery. We completed an abbreviated trawl sampling of juvenile perch in October 2019 to investigate if trawl catch might predict future age class strength.

METHODS

We continued to use the same lake area divisions (east, west, and south), effort and a sub-sample of historic transect sites and methods developed in 1998 and 1999 and described by Janssen et al. (2003). We chose three trawl sites in each of the areas with the highest historical perch catch to sample in 2019. Trawl transect locations were as close as possible to the established sites. Exact sites change due to water levels and macrophyte bed development. Trawl sites are moved into deeper water to avoid dense macrophyte beds that foul the trawl. At each sample site we counted all yellow perch collected either individually or with pound counts of age-0 fish (depending on numbers caught). We measured all perch greater than 90 mm (age-1 and greater) and all or a random subsample of age-0 perch (depending on numbers) to the nearest 1 mm.

RESULTS

We completed nine, five-minute trawl transects at 2.5 miles per hour on October 17, 2019 and collected 9,226 perch (Table 9). Length frequencies of fish captured are presented in Figure 21. The majority of perch were age-0 (9,192) with a mean total length of 59 mm and only four age-1 fish were captured. Perch ranged in size from 45 to 375 mm.

MANAGEMENT RECOMMENDATIONS

1. Re-establish annual trawling surveys for juvenile perch and determine whether results may provide insight into the future quality of the perch fishery.

2. Utilize gill nets with mesh size targeting age-1 to age-3 perch in conjunction with trawling in 2020 to help evaluate effectiveness of trawl and monitor survival of juvenile age classes.

3. Conduct nighttime trawling in 2020 to determine if catch rates of age-1 and older fish can be improved.

LAKE CASCADE HOLIDAY ANGLER COUNT INDEX

ABSTRACT

Holiday angler counts have been conducted annually at Lake Cascade since 1996, as an index to assess trends in angler effort. Each year on Memorial Day, Independence Day, and Labor Day, we count shore anglers and fishing boats on Lake Cascade to assess angling effort relative to previous years. In 2019, we counted 52 shore anglers and 33 boats on Memorial Day, 25 shore anglers and 50 boats on Independence Day, and 46 shore anglers and 30 boats on Labor Day. Mean holiday index counts in 2019 for shore anglers and number of fishing boats were 41 and 38, respectively, for a combined mean index count of 73. The average of combined mean index counts from 2000 to 2004 (prior to fishery restoration) was 27, whereas the average of combined mean index counts from 2006 to 2019 (post-restoration) is 66. In general, angler counts have increased since the fishery restoration efforts in 2004 through 2006, and the 2019 index count is the fourth highest value observed in the nine years since the fishery restoration project was completed in 2006.

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INTRODUCTION

In order to monitor long-term trends in angling effort on Lake Cascade, we have conducted annual boat and shore angler counts on Memorial Day, Independence Day, and Labor Day each year since 1996. These counts serve as an index of trends, and are a relatively inexpensive way to track changes in angling effort between years when more comprehensive creel surveys were not completed. These holiday angler counts coincidentally started just prior to the collapse of the Yellow Perch *Perca flavescens* (hereafter, perch) fishery in the early 2000s (see Lake Cascade Fall Gill-netting Survey section of this report for historical background on the fishery). These index counts have given managers a relatively inexpensive tool to monitor changes in angling effort prior to and during the fishery collapse, as well as after the perch fishery restoration project was completed (2004-2006). We completed holiday angler counts again in 2019 to add to the long-term trend dataset.

OBJECTIVES

1. Conduct holiday index counts to add to long-term trend angler effort data in Lake Cascade.

METHODS

The total number of fishing boats (boats – not anglers) and number of shore anglers were enumerated on Memorial Day, Independence Day, and Labor Day, on Lake Cascade in 2019. A single count was conducted each day, beginning at 10:00 AM and ending at approximately 1:00 PM, or when the entire lake was completed. Surveyors in 2019 used a motorized boat to travel the entire lake and counted both the number of fishing boats and number of shore anglers. Prior to 2016, these counts were conducted from a fixed-wing aircraft. We averaged the counts of fishing boats and shore anglers across all three surveys to derive the index count for 2019, as has been done in previous years.

RESULTS

On Memorial Day 2019, we counted 52 shore anglers and 33 boats, on Independence Day we counted 25 shore anglers and 50 boats, and on Labor Day we counted 46 shore anglers and 30 boats. Mean index counts for shore anglers and fishing boats were 41 and 38, respectively (Table 10, Figure 24). The average of combined mean index counts from 2000 to 2004 (prior to fishery restoration) was 27, whereas the average of combined mean index counts from 2006 to 2019 (post-restoration) was 66. In general, angler counts have increased since the fishery restoration efforts in 2004 through 2006, and the 2019 combined index count is the fourth highest value observed in the ten years of counts since the fishery restoration project was completed in 2006.

DISCUSSION

The combined holiday index count in 2019 was similar to 2018 which was the highest count since 2015, and the 2019 boat count was the second highest recorded since 2014. In general, angler counts have increased since the perch restoration efforts in 2004 through 2006. Although counts have fluctuated up and down since 2008, those trends may not necessarily be indicative of trends in angler effort. With only three days of counts for the entire year, inclement weather on any count day may have a significant reduction of some yearly means and should be recorded in the future to help determine whether this is a factor. However, weather can change from that observed during count times and it can be difficult to determine what weather conditions deter anglers from fishing that day, all day. Previous count data did not include weather conditions at the time of the survey. In any case, the 2019 combined index count is the fourth highest value observed in the 10 years of counts since the fishery restoration project was completed in 2006, and therefore indicates a relatively high amount of fishing effort this year.

We assume the amount of angler effort at Lake Cascade is directly correlated to angler success. That is, when fishing is good, more anglers come to fish the lake. However, angler counts are not necessarily correlated with the quality of perch fishing, only. Bass anglers have also increased on Lake Cascade in recent years, which may offset a reduction in effort due to any decrease in the quality of perch fishing. Gathering angler catch rate and target species data to supplement index counts/effort data is necessary to better understand what species are driving fishing effort and inform management of the fishery. The last comprehensive creel surveys conducted at Lake Cascade were in 2016 and 2009. Conducting comprehensive creel surveys is important, both for collecting angler catch rate information, and to ensure holiday index counts are accurately representing overall annual angling effort. We recommend that repeatable creel methodology be developed for conducting comprehensive surveys once every three to five years at Lake Cascade. Creel surveys should focus on collecting angler effort, catch, and harvest data, as well as target species data to inform relative importance of each species' contribution to the overall value of the fishery. In addition, recording weather and ice conditions while conducting creel surveys should help us determine how much these factors affect angler effort. For example, ice conditions were poor and unsafe in 2016, which may have contributed to low ice fishing angler effort that year. Future analysis of these data should allow us to more accurately assess trends in angler effort and catch, regardless of weather conditions at the time of holiday index counts.

MANAGEMENT RECOMMENDATIONS

1. Continue holiday index angler counts to monitor trends in angler effort.

2. Complete a standardized annual, lake wide, winter angler vehicle count.

3. Develop repeatable methodology for comprehensive creel surveys to be conducted every three to five years.

4. Record weather conditions during creel/ angler effort surveys.

LAKE CASCADE YELLOW PERCH EXPLOITATION STUDY

ABSTRACT

To evaluate angler harvest (exploitation) of Yellow Perch *Perca flavescens* (hereafter, perch) in Lake Cascade, and determine whether more restrictive fishing regulations are warranted, we have utilized the Tag-You're-It program since 2009. We collected and tagged 126 perch from May 9 through June 14, 2019, ranging in size from 251 to 378 mm and averaging 303 mm, 11 of which were $50 reward tags. We had seven non-reward tags and one reward tag harvested and one reward tag released through March 2019. The estimated harvest and exploitation rates for both (± 90% CI) was 10.6% (± 8.5). The majority of perch (5) were harvested in May. The remaining four were caught in July, August, and September. Fishing mortality on adult perch in Lake Cascade is low, and many fish are reaching maximum age and dying of old-age, before being harvested. The data gathered through this tagging and exploitation evaluation indicate harvest restrictions for perch on Lake Cascade are not biologically warranted.

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INTRODUCTION

As the quality of the Yellow Perch *Perca flavescens* (perch) fishery in Lake Cascade has improved over the last decade and a half, angling pressure has increased (see Lake Cascade Holiday Angler Counts section, this report). Current fishing regulations for Lake Cascade do not restrict harvest of perch. Classified under "all other fish species", perch in Lake Cascade have no bag, size, or possession limits. Many anglers who fish for perch in Lake Cascade have expressed concerns that unrestricted harvest may pose a threat to the future quality of the perch fishery, and have suggested that IDFG adopt restrictive bag and possession limits to prevent overharvest. In order to evaluate angler harvest (exploitation) of perch in Lake Cascade, we have utilized the Tag-You're-It program (Meyer, et al. 2012) since 2009 to determine whether more restrictive regulations are warranted, The data gathered through this tagging and exploitation evaluation effort will help managers determine whether harvest restrictions could improve the fishery.

METHODS

We used standard IDFG lake survey trap nets described in (IDFG 2012) set at various locations throughout the lake in the spring, to collect spawning perch large enough to be vulnerable to harvest (> 250 mm TL). Trap net locations were chosen non-randomly, and were not recorded, but were dispersed over a variety of habitats and locations throughout the lake. Traps were attached to or very near shoreline at locations where there was a smooth lake bottom, sloping to a minimum depth equal or greater than the height of the trap frame (1.8 m) and a maximum depth of 5 m when the net was fully extended and sitting on the bottom. Perch were measured to the nearest mm and tagged with a bright orange T-bar anchor tag between the vertebral skeleton and the dorsal fin base. Each unique tag number was entered into the "Tag-you're-it" database, along with the TL of each fish. Methods utilized to determine exploitation rates of tagged fish are presented in Meyer et al. (2010).

To estimate single-year exploitation in 2019, we included all tag returns reported through March 2020, using an estimated tag loss rate of 1.2% and an angler reporting rate of 58.5% (Meyer, et al. 2012). For all previous years reported, we calculated single-year exploitation using the same adjusted rates.

RESULTS

We collected and tagged 126 perch from May 9 through June 14, 2019, ranging in size from 251 to 378 mm and averaging 303 mm (Figure 25) of which 11 were $50 reward tags. Angler reported tags included seven none reward tags and one reward tag harvested and one reward tag reported released through March 2019. The estimated harvest and exploitation rates for both (± 90% CI) was 10.6% (± 8.5). The majority of perch (5) were harvested in May. The remaining four were caught in July, August, and September. No tags were returned from ice anglers. Annual perch exploitation rates (May through April) in Lake Cascade since 2009 have ranged from a low of 7% (2015) to a high of 17% (2009 and 2018), with an overall mean through 2019 of 14%.

DISCUSSION

Issermann, et al. (2005) states that there is little information available in the literature regarding Yellow Perch exploitation rates in recreational fisheries, but that reported rates are generally less than 30%, but may exceed 60% in some cases. In Lake Cascade, perch exploitation rates are comparatively much lower than these reported values, averaging 14% over all years through 2019, and ranging from a low of 7% (2015) to a high of 17% (2009 and 2018). These estimated exploitation rates are low enough that we believe fishing mortality has very little impact on perch abundance in Lake Cascade. We do not have estimates of natural mortality for perch in Lake Cascade, but high levels of mortality on age-0 through age-1 perch in Lake Cascade have been previously documented and attributed to predation by Northern Pikeminnow (Bennett 2004) and perch are effective predators on juvenile perch. October fisheries surveys and resulting perch length frequency data indicate high mortality rates at the age-0 to age-3 life stage since 2014. Catch curves developed using annual fall gill-netting surveys (see Lake Cascade Fall Gill-netting Survey section this report), also suggest mortality is high during those early life stages, but that once perch reach approximately age-4, or 225 mm in length, total mortality is relatively low. This emphasizes the importance of finding ways to increase perch survival in early life stages to increase abundance of adult perch over the long term, thereby increasing the quality and value of the perch fishery in Lake Cascade.

The exploitation evaluations we have conducted for perch in Lake Cascade over the past decade have also given us some insight into when (what time of year) most perch are caught. The majority of tags are returned May through July, with two other peaks in January/February (ice fishing) and September (Figure 26). The January/February ice fishing period is very popular as perch are predictable and return to many of the same locations year after year. Both state and world record Lake Cascade perch (emphatically termed "jumbo perch") were caught through the ice when perch are maturing for the spawn at ice out and maximum weight is obtained by females with large numbers of fully developed eggs. The March/April period will likely never be a feasible time period to increase perch catch rates, as this is the period when thin ice covers the majority of the reservoir and thus, conditions are not conducive to any type of fishing. The May through early July peak corresponds to the period during and after perch spawning takes place when perch will typically gather in large schools and before weed beds become very extensive. This period also corresponds with two major fishing-related holidays: Memorial Day and the Fourth of July. Perch can become difficult to find and less predictable in late July and August. Future studies aimed at increasing angler catch rates for perch should focus on the late July and August period, when catch rates are currently relatively lower.

Improving winter access to Lake Cascade could increase angler success during the ice fishery. The ice fishery at Lake Cascade has always been very popular and typically runs from mid-December to early/mid-March. While no tag returns were reported in 2019, past Tag return data suggests that approximately 17% of all perch harvest occurs during the ice fishery. While ice fishing is very popular, harvest is relatively low during this time. Reasons for the low harvest include weather and ice conditions, depth of snow and slush on the ice, and distance to the best fishing areas, some of which are miles from lake access sites. The large size of Lake Cascade (12,173 ha) and limited access during winter makes some of the best fishing locations accessible only to the most dedicated anglers on foot, skis or to those with snowmobiles and ATVs. In addition to fighting poor access conditions, most anglers pull a sled with them to carry all of the required gear, increasing the difficulty. All of these factors can severely limit the access to known fishing areas, forcing many anglers to fish close to access sites with poorer fishing success. In addition to difficult ice access issues at times, catch rates for perch on Lake Cascade can be quite low even for the experienced angler. Many anglers report "seeing" large numbers of perch on their fish finders and fish “looking/following” their lures or bait, but getting fish to bite can be difficult. Mean perch ice fishing harvest rates (fish/h) in 2015 and 2017 were 0.23 and 0.34 respectively (Janssen et al. 2016a; Janssen et al. 2016b). In order to increase angler success during the ice fishing season, we have started discussions with Lake Cascade State Park staff regarding creation of additional ice fishery access locations in better fishing areas. Improvements could be made to create new parking areas, and remove snow regularly from those areas to help improve angler access to better fishing locations during the ice fishing season.

MANAGEMENT RECOMMENDATIONS

1. Current fishing rules for perch are appropriate based on low estimated exploitation rates.

2. Combine telemetry data, forage information, and fishing technique knowledge to increase angler information/education outreach, and help increase catch rates for perch anglers throughout the year in Lake Cascade.

3. Work with State Park staff to improve winter access to prime fishing locations during the ice fishing season.

PAYETTE LAKE

ABSTRACT

Our main objective in Payette Lake is to reduce Lake Trout abundance to a point at which kokanee survival increases. More than 1,800 Lake Trout have been removed since suppression efforts began in 2014, most of which (*n* = 1,409) were removed in the last two years. A total of 784 Lake Trout were captured in 2019 during 15 weeks of netting. Gill net CPUE showed a 64% decline in catch rate from 2018 to 2019 for mesh sizes used in both years (5.17 fish per net-night to 1.86 fish per net-night) and mean relative weight increased slightly. Recent observed changes in CPUE and relative weight suggests we are beginning to see positive results from suppression efforts. Additionally, kokanee spawner abundance in the index transect of the North Fork Payette River in 2019 was nearly 3-fold higher than has been observed in over a decade, suggesting kokanee survival is increasing.

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INTRODUCTION

Lake Trout *Salvelinus namaycush* and kokanee salmon *Oncorhynchus nerka* have coexisted in Payette Lake for 65 years. Kokanee salmon are native to Payette Lake, but overfishing in the late 1800s and early 1900s resulted in the need to begin stocking kokanee from outside sources as early as 1930. Lake Trout were first stocked in 1955. The fishery was at its' peak by the mid-1990s, as kokanee salmon were highly abundant and trophy-sized Lake Trout were common, with relative weights well over 100. Over the next two decades, from 1994 to 2014, standard gill-netting surveys showed relative abundance of Lake Trout increased four-fold while relative weight declined substantially. This corresponded with a total collapse of the kokanee fishery. The mean estimated spawners 27,500 (between 1998 and 2001) declined to a mean of 774 spawners (between 2010 and 2017). The growing Lake Trout population depleted kokanee abundance and kokanee were unable to rebound, despite stocking of 300,000 to 400,000 fingerlings per year from 2008 through 2014.

IDFG stopped stocking kokanee in Payette Lake in 2014, and began efforts to reduce Lake Trout abundance to reduce predation on kokanee. In 2014, staff removed 376 Lake Trout, and in 2018 we removed 649. Neither Lake Trout relative weight nor kokanee spawner abundance increased during that period (2014 to 2018), suggesting additional suppression effort was needed to determine if this strategy could be effective to increase the kokanee population. The 2019-2024 IDFG Statewide Fisheries Management Plan (FMP; IDFG 2018) lists an objective for Payette Lake to "maintain/improve the Payette Lake kokanee fishery by reducing Lake Trout predation". McCall IDFG fisheries staff will continue to reduce Lake Trout abundance in Payette Lake throughout the current management period. We will continue to monitor the effectiveness of suppression efforts by documenting trends in Lake Trout abundance, size structure, and relative weight, and by monitoring kokanee abundance through annual spawning counts.

OBJECTIVES

1. As per the statewide Fisheries Management Plan (2019-2024), reduce Lake Trout abundance through suppression gill netting.

2. Quantify changes in Lake Trout relative abundance, size structure, and body condition to determine effectiveness of suppression efforts.

3. Determine Lake Trout age and growth for development of an age-length key, sex ratios, and ages-at-maturity for later development of population growth rate model.

4. Quantify kokanee spawner abundance in the North Fork Payette River above Payette Lake as an index of effectiveness of suppression efforts.

METHODS

Nets used in 2019 were built by Hickey Brothers Research (Sturgeon Bay, WI). Nets were sinking-style, 91.5-m long, and were constructed of clear monofilament. Nets consisted of three mesh sizes each: 38-, 51-, and 64-mm stretched. Nets were typically set in gangs of two to four 91.5-m nets tied together. Netting sites were subjectively chosen to maximize catch efficiency and were dispersed throughout the southwest basin, southeast basin, and the narrows. Nets were typically set on flats and ridges, in water no less than 12 m in depth to avoid catching large numbers of Northern Pikeminnow *Ptychocheilus oregonensis* and Largescale Suckers *Catostomus macrocheilus*. Nets were set mid-day, fished all night and pulled the following morning. Effort (expressed as number of net-nights) was recorded as number of 91.5-m nets fished per night. Catch-per-unit-effort (CPUE) was quantified as the number of fish caught per net-night. The netting period in 2019 was from June 18 to September 25.

All netted Lake Trout were enumerated, measured (mm, total length), and weighed (g). Mesh size was recorded for each fish, but type of entanglement (i.e. gilled versus tooth-hooked) was not. Non-target fish were not measured or enumerated. Lake Trout size structure was summarized using proportional stock density (PSD) standard length categories: stock (≥280 mm), quality (≥500 mm), preferred (≥700 mm), memorable (≥850 mm), and trophy (≥1,000 mm; Piccolo et al. 1993). Body condition of Lake Trout was evaluated using relative weight. Mean relative weight and 95% confidence intervals (±CI's) were calculated for all Lake Trout greater than 400 mm to compare between years.

All Lake Trout less than 830 mm were euthanized. Because large Lake Trout are important to anglers, we released a portion of live fish greater than 830 mm. However, because we wanted to develop an age-length-key in 2019, we sacrificed up to 10 Lake Trout per 10-mm length group (over 830 mm) to include these older fish in our age and growth analysis. Sex and maturity (immature/mature/ripe) were recorded for all euthanized fish.

We collected sagittal otoliths from up to 10 Lake Trout per 10-mm length group for age and growth analysis. Otoliths were mounted in epoxy, cross-sectioned with a low-speed saw (Beuhler Isomet), and viewed under a light microscope at 25x to 40x magnification to assign ages and develop an age-length key. The age-length key was then applied to all unaged Lake Trout caught in 2018 and 2019 to develop age-frequency distributions and evaluate suppression impacts among age classes in those years.

Consistent with methods in 2018, all released fish were marked with either a pink or yellow spaghetti tag to determine how much relative movement occurs throughout the various lake basins. Yellow represented a southwest basin capture area and pink the narrows and southeast basin capture area.

Twice weekly during the kokanee spawning run in the North Fork Payette River (above Payette Lake), the stretch of river from the mouth of Fisher Creek downstream approximately 3,400 m and adjacent to the 5010 benchmark (on the Granite Lake 24k topographic map) was walked and all live spawners counted. The total run estimate was made by multiplying the largest daily count by 1.73 (Frost and Bennett 1994). Samples of dead post-spawn kokanee that still have an intact tail were measured for total length.

RESULTS

A total of 784 Lake Trout were captured in the 15 weeks of netting in 2019. Netting mortalities and fish euthanized in 2019 totaled 760. More than 50 separate netting events were conducted where multiple gill nets were set overnight. In total, we fished 537 net-nights, and mean catch rate across all sizes of mesh was 1.5 fish per net-night (Table 11). By comparison, mean catch rates varied from 3.4 to 5.8 fish per net-night from 2006 to 2018 (Figure 27), though net construction and mesh sizes were not consistent throughout that period. Two mesh sizes were consistent between 2018 and 2019 (51- and 64-mm), allowing valid CPUE comparisons. CPUE for those two mesh sizes showed a 64% decline in abundance from 2018 to 2019 (5.17 fish per net-night to 1.86 fish per net-night). In total, more than 1,800 Lake Trout have been removed from Payette Lake since 2014.

Gill netted Lake Trout caught in 2019 ranged in length from 142 to 1,070 mm (mean ± SD; 511 ± 202 mm; Figure 28). The majority of Lake Trout captured were quality length (proportional stock density [PSD] = 41, PSD-preferred = 22, PSD-memorable = 11, PSD-trophy = 1). Mean relative weight (± SD) for Lake Trout greater than 400 mm in 2019 was 81 ± 16, which is a slight improvement compared to the most recent sampling events since 2014 (Figure 29).

Lake Trout age varied from 2 to 42 years (*n* = 276; Figures 30 and 31). Sixty-eight percent (68%) of the Lake Trout caught in 2019 were estimated to be between age-4 and age-12. Peak abundance in our catch occurred at age-7. By comparison, in 2018 when larger mesh sizes were used, peak abundance in our catch occurred at age-9, and 49% of the catch was between age-4 and age-12 (proportionally more fish older than age-12 were caught).

The sex ratio of Lake Trout captured in 2019 was 1.4 (males per female; *n* = 758); sex was undetermined for 36 fish. Males matured slightly earlier than females. First observed age-at-maturity was age-6 for males and age-8 for females. Less than half of males were mature up to age-11, and less than half of females were mature up to age-12.

We captured 98 fish greater than 830 mm, 33 of which were released alive. Two of these fish had been marked with yellow tags and released in 2018, and were captured in 2019 in the same basin in which they were marked. We marked the other 31 Lake Trout with spaghetti tags before release (12 yellow and 19 pink).

We completed five kokanee spawner counts on the North Fork Payette River in 2019. The first count was made on August 30 and the last on September 13. The peak count (1,955) was made on September 10. The total spawning run estimate was 3,382 (1,955*1.73) fish (Table 12). Spawning fish ranged in length from 362 to 493 mm with a mean (± SD) of 424 ± 33 mm based on sampled carcasses (Table 12).

DISCUSSION

More than 1,800 Lake Trout have been removed from Payette Lake since suppression efforts began in 2014, most of which (*n* = 1,409) were removed in the last two years. Recent observed changes in CPUE and relative weight suggest we are beginning to see positive results from suppression efforts. Lake Trout CPUE values for mesh sizes used in both 2018 and 2019 showed a 64% decline in relative abundance between those years. This drastic decrease in CPUE should not be taken as an equal decline in actual Lake Trout abundance, as several factors (e.g. netting locations, changes in net orientation) may have played a role in decreased catch rates in 2019. Despite these sampling inconsistencies, reduced catch rates suggest that Lake Trout abundance is declining. In addition, mean relative weight increased in 2019 for the first time in nearly a decade. Body condition assessment can provide useful insight into the overall health of the population, and whether forage limitations exist (i.e. competition; Ng et al.

2016). The observed increase in relative weight in 2019, in combination with the observed decrease in CPUE, suggests recent reductions in Lake Trout abundance have resulted in reduced intra-specific competition and improved growth. This is encouraging, but ultimately we are trying to reduce Lake Trout abundance to a point at which conditions are more favorable for increased kokanee survival. Significantly reducing Lake Trout abundance alone may not necessarily achieve those results, as the remaining Lake Trout may increase consumption of kokanee. Monitoring kokanee survival and abundance is critical to evaluating the effectiveness of these suppression efforts.

Kokanee spawner abundance in the index transect of the North Fork Payette River in 2019 was nearly 3-fold higher than has been observed in over a decade. This suggests Lake Trout predation on kokanee may be declining. However, spawner abundance has been so low in recent years that a 3-fold increase (from 1,000 to just over 3,000 spawning individuals) should not be interpreted as a success just yet, especially relative to spawner abundances in excess of 40,000 individuals in the mid-1990s. If predation pressure has been reduced, it may take several years to see an increase in the abundance of naturally-reproduced kokanee in Payette Lake. Ultimately, the success of this project will be measured by an increase in kokanee abundance that results in development of a quality fishery. In 2020, kokanee fingerlings will be stocked in Payette Lake again for the first time since 2014. Due to a reduction in the availability of early-spawning kokanee (currently the dominant life-history in Payette Lake), late-spawning kokanee will be stocked in 2020. This is unfortunate for monitoring purposes, as we have been assessing kokanee trends using index spawner counts for over 30 years, but these index counts will not be useful for determining how well these late-spawning fish survive. Late-spawning kokanee are known to have a higher propensity to spawn around the shoreline than early-spawners, and any stream spawning that does occur will happen when snow and ice make surveys difficult. Instead, annual gill netting surveys will be necessary to track survival of these late-spawning kokanee. Annual gill net monitoring of these stocked kokanee, paired with continuation of annual spawner counts for naturally-produced early spawning fish, will be necessary for determining the effectiveness of suppression efforts.

As suppression efforts continue over the next several years, refinement of our Lake Trout data collection will be beneficial to quantifying the effects of suppression. Data collected in 2019 was used to construct an age-length key for the Lake Trout population in Payette Lake, and this will be very useful for quantifying the effects of suppression in subsequent years. This age-length key will allow us to convert selectivity-corrected length-frequencies to age-frequencies and calculate annual mortality estimates. Unfortunately, selectivity-corrected length-frequencies are not possible with 2019 catch data because type of entanglement (i.e. gilled versus tooth-hooked) was not recorded. This information should be collected in future years. Additional rate function information (i.e. growth and maturity) collected in 2019 and in future years will be used to determine the rate of population growth (λ) for a given year, which will help provide insight into how effective we are with suppression efforts, and how much additional effort is needed to decrease Lake Trout population abundance over the long-term (i.e. $\lambda < 1.0$).

There are Lake Trout anglers who do not support Lake Trout suppression efforts in Payette Lake. In order to provide opportunity for those anglers, as well as kokanee anglers, the objective for the Payette Lake fishery is to maintain Lake Trout abundance at relatively low level to allow for increased survival and abundance of kokanee. Ng et al. (2016) suggests the best way to accomplish this objective is likely a ‘juvenile removal’ method. Gill net mesh sizes used in 2019 (38, 51, and 64 mm) were very effective at capturing smaller Lake Trout; more effective than the larger mesh sizes used in previous years. Sixty-eight percent of the Lake Trout captured in 2019 were between the ages of 4 and 12. Many larger Lake Trout are only tooth-hooked, which allows for live release if desired. We plan to continue using these nets in future years. However, maintaining a relatively high abundance of older, larger Lake Trout may not be conducive to achieving our desired objectives either. In Flaming Gorge Reservoir, maintenance of an abundance of trophy-size Lake Trout resulted in high prey consumption rates (Luecke et al. 1994), which is contrary to our objectives in Payette Lake. In order to maximize success of our suppression efforts, we recommend supplementing small-mesh netting efforts with larger mesh in order to remove a portion of trophy size individuals as well. Hansen et al. (2019) provides some guidelines for particular mesh sizes that may be most effective for long-term suppression of Lake Trout populations.

There is a need to set measurable objectives for our fishery management program on Payette Lake. These may include targets for Lake Trout abundance (gill net CPUE) or kokanee abundance (gill net CPUE or spawner counts), targets for Lake Trout body condition (mean relative weight), targets on the number of Lake Trout removed in a given year (difficult to quantify without population abundance estimates), or targets for kokanee catch rates (creel surveys). The first three of these metrics may be the most logical to set as objectives. By establishing an annual trend monitoring (gill netting) program for Payette Lake, we will be able to monitor relative abundance (gill net CPUE) for both Lake Trout and kokanee, as well as collect Lake Trout length and weight data for comparisons of body condition between years. As soon as possible, we should resume stocking early-spawning kokanee rather than late-spawners, to enable us to resume evaluation of relative kokanee survival with index spawner counts, as has historically been done. The current suppression program will last at least until the end of the current FMP period (2019-2024), and by the end of that period measurable alternative targets should be developed for the next planning period.

MANAGEMENT RECOMMENDATIONS

1. Continue with suppression efforts to reduce Lake Trout abundance through the current FMP period (2019-2024).

2. Work with the Fisheries Biometrician to develop an annual monitoring program in Payette Lake (incorporating Lake Trout suppression data) that can quantify the level of suppression necessary to improve kokanee survival and abundance.

3. Re-establish kokanee fingerling stocking, and evaluate differences in survival between various stocking strategies to determine most appropriate strategy for meeting management objectives.

4. Develop measurable objectives for Lake Trout and kokanee management in Payette Lake to evaluate suppression and monitoring efforts.

Table 1. Total effort, the number of fish caught, and catch-per-unit-effort (CPUE, fish/h) during angling and gill netting high mountain lakes surveyed by the McCall subregion in 2019.

Lake	Effort type	Total effort (hours)	Number of fish captured	CPUE (fish/h)
Boulder Lake	angling	3.5	0	0.0
Cly Lake #3-4	gill netting/	22.0	22	1.0
	angling	27.5	28	1.0
Corral lake	gill netting/	48.0	0	0.0
	angling	6.0	1	0.2
Crater Lake	angling	19.5	72	3.7
Deep Lake	angling	9.5	4	0.4

Table 2. The number of fish captured and summary statistics (total length [TL] and relative weight [W_r]) by species for fish captured in high mountain lakes surveyed by the McCall subregion in 2019.

Lake	Species	Number captured	Mean TL (mm) (range)	Mean W_r (range)
Boulder Lake	N/A	0	N/A	N/A
Cly Lake #3-4	Cutthroat Trout	48	312 (209-385)	N/A
	Rainbow Trout	2	275 (250-300)	N/A
Corral Lake	Tiger muskie	1	666 (N/A)	N/A
	Rainbow Trout X Cutthroat Trout	54	225 (143-245)	62 (33-85)
Crater Lake # 1	Cutthroat Trout	11	237 (200-267)	68 (58-77)
	Rainbow Trout	7	275 (185-246)	66 (60-79)
Deep Lake	Brook Trout	4	219 (205-235)	24 (20-31)

Table 3. Summary statistics (number captured N, mean and range of total length TL (mm), and relative weight W_r) for fish captured in lowland lakes surveyed by the McCall subregion in 2019.

Lake	Species	N	Mean TL (range)	Mean W_r (range)
Granite Reservoir	Rainbow Trout	25	274 (233-386)	75 (62-88)
	Redside Shiner	6	84 (38-102)	NA
	Brook Trout	1	206	93
Herrick Reservoir	Yellow Perch	105	236 (119-345)	55 (16-67)
	Rainbow Trout	62	256 (136-355)	81 (46-119)
Lost Valley Reservoir	Yellow Perch	60	172 (100-265)	47 (39-63)
	Rainbow Trout	21	326 (275-375)	80 (72-89)
Horsethief Reservoir	Rainbow Trout	97	255 (150-388)	90 (66-115)
	Brown Trout	51	298 (174-366)	89 (63-112)
	Black Bullhead	21	233 (177-305)	81 (56-113)
	kokanee salmon	8	323 (231-371)	91 (84-97)
Little Payette Lake	Northern Pikeminnow	66	374 (195-564)	NA
	Largescale Sucker	37	521 (270-600)	NA
	Smallmouth Bass	6	403 (180-470)	84 (76-98)
	kokanee salmon	4	206 (197-219)	73 (67-76)
	Mountain Whitefish	2	386 (376-395)	125 (120-131)
	tiger muskellunge	1	930	137.3

Table 4. Total numbers of fish caught, relative weights and total length (TL) by species collected with gill nets in Lake Cascade in October 2019.

Species	Number caught	% Total catch	Mean relative weight	Mean condition factor	Mean TL (mm)	Min TL (mm)	Max TL (mm)
Black Bullhead	362	28.4	83.1		239	130	435
Northern Pikeminnow	227	17.8	--	--	318	125	552
Largescale Sucker	226	17.7	--	--	508	161	670
Yellow Perch	194	15.2	89.4		280	140	392
Smallmouth Bass	80	6.3	97.3		382	152	506
Rainbow Trout (Hatchery)	49	3.8		1.10	383	273	535
Kokanee (late) Spawner)	42	3.3		0.96	399	273	447
Rainbow Trout (natural)	36	2.8		0.98	420	168	585
Mountain Whitefish	35	2.7	105.9		318	185	429
Pumpkinseed	15	1.2	103.9		117	95	143
Largemouth Bass	2	0.2	124.2		295	150	440
White Crappie	5	0.4	120.0		261	223	310
Bridgelip Sucker	1	0.08	--	--	403	403	403
Grand Total	1274						

Table 5. Total catch and mean catch-per-unit-effort (CPUE) with 90% confidence intervals of Yellow Perch, Northern Pikeminnow, Yellow Perch greater than 250 mm, and Northern Pikeminnow greater than 350 mm total length collected in Lake Cascade in 1991, 2003, 2005, 2008 and annually in October from 2012 through 2019 by McCall subregion staff.

	Yellow Perch				Northern Pikeminnow					
Year	Total catch	Mean CPUE	Mean CPUE >250 mm	% > 250 mm	Total catch	Mean CPUE (± 90% CI)	Mean weight (g)	Total catch > 350 mm	Mean CPUE > 350 mm	% > 350 mm
1991[1]	1,361	109/net	Na	60	795	31/net	618	673	na	85
2003[2]		1.2/net	0.3	25	na	na	979	651	na	96
--Yellow Perch Restoration Project (2004 - 2006)---										
2005[3]	na	7/net	na	15	na	na	na	na	na	7
2008[4]	na	27/net[4]	18 ± /net[4]	66	na	5/net[4]	NA	na	1/net[4]	11
2012[5]	608	40 ± 11	18 ± 4	45	351	23 ± 10	413	110	7 ± 3	31
2013	739	49 ± 28	13.5 ± 23	28	213	14 ± 7	391	70	5 ± 2	33
2014	441	29 ± 10	19 ± 32	66	335	22 ± 10	441	122	8 ± 4	36
2015	465	31 ±10	14.5 ± 5.5	47	275	18 ± 6	445	118	8 ± 4	43
2016	400	27 ± 8	17 ± 7	63	243	16 ± 6	438	58	4 ± 2	24
2017	188	12.5 ± 4	10 ± 5	58	139	9 ± 6	502	65	4 ± 2	47
2018	183	12 ± 3	7 ± 3	60	239	16 ± 6	419	64	4 ± 2	27
2019	194	13 ± 4	8 ± 2.5	59	227	15 ± 6	403	65	4 ± 2.5	29

1. 15 sinking experimental nets, 11 floating experimental nets, one net per site.
2. 80 experimental floating and sinking gill nets, one net per site.
3. 17 sinking IDFG experimental nets, one net per site.
4. 9 experimental nets; three floating and six sinking, one net per site.
5. Catch per site, 15 sites, one floating and one sinking net/site (2012 through 2018).

Table 6. Proportional (PSD) and incremental Relative Stock Densities** (RSD) for 250 , 300 and 380 mm Yellow Perch (total length) collected annually with gill nets in Lake Cascade in October 2012 through 2019.

Year	PSD	RSD-250	RSD-300	RSD-380
2012	69	45	27	1
2013	66	27	13	1
2014	89	65	32	1
2015	57	47	27	2
2016	78	63	42	3
2017	83	77	58	4
2018	72	56	46	0 (1 fish)
2019	80	59	48	3

**Stock and quality lengths = 130 mm and 200 mm respectively.

Table 7. Total catch, mean catch-per-unit-effort (CPUE), mean and range of total lengths of hatchery holdover (> 399 mm) and natural origin Rainbow Trout collected from Lake Cascade annually during fall fish surveys (15 sites per year) in October 2014 through 2019.

Year	Total catch holdover/natural	Mean TL (mm) holdover/natural	Holdover TL (mm) range	Natural TL (mm) range
2014	26/6	455/522	405-515	485-555
2015	27/4	479/437	405-565	385-485
2016	23/31	452/460	405-545	305-745
2017	8/11	458/360	405-525	170-490
2018	28/15	464/464	405-535	345-635
2019	20/36	441/420.5	405-535	168-585

Table 8. Smallmouth Bass total catch, mean catch-per-unit-effort (CPUE), proportional stock densities (PSD) and incremental Relative Stock Densities* (RSD-400 and 480 mm) of Smallmouth Bass collected with gill nets in Lake Cascade in October 2012 through 2019.

Year	Total catch	Mean catch (± 90% CI)	PSD	RSD-400	RSD-480
2012	64	5 ± 3	69	32	2
2013	38	2.5 ± 5	95	53	3
2014	67	4.5 ± 3	72	27	0
2015	142	9.5 ± 5	83	22	1
2016	65	4 ± 3	93	36	0
2017	41	3 ± 2	88	46	5
2018	59	4 ± 3	75	17	0
2019	80	5 ± 3	87	37	6

* Stock and quality lengths = 180 mm and 300 mm, respectively

Table 9. Mean catch per five-minute tow of Yellow Perch collected with trawl in Lake Cascade in October 1998 through 2010 and 2019.

Year	Mean catch/tow
1998	2
1999	21
2000	10
2001	18
2002	7
2003	12
2004*	93
2005*	220
2006*	436
2007	651
2008	1,140
2009	1,029
2010	59
2019	1,025**

* Years with adult Yellow Perch introductions and Northern Pikeminnow removal
** Highest historic catch sites selected

Table 10. Mean boat and shore angler counts on Lake Cascade on three major holidays including Memorial Day, July 4th, and Labor Day, in 1982, 1991, 1992, 1996 - 2010, and 2014 - 2019 with corresponding intensive creel survey angler hour estimates for 1982, 1991, 1992, 2009 and 2016.

	Mean holiday index counts		Creel surveyed angler hours (hours * 1000)			
Year	Mean boat count	Mean shore angler count	Boat anglers	Shore anglers	Ice anglers	Total pressure
1968[1]	--	--	32.3	27.4	n/a	59.7
1969[1]	--	--	38.7	27.9	n/a	66.6
1970[1]	--	--	53.3	24.8	n/a	81.3
1982	154	85	254.6	119.9	39.8	414.2
1986	n/a	n/a	212.8	128.2	50.8	391.8
1991	41.5	32	135.2	102	13.8	237.2
1992	52.5	28	144.2	177.3	61.7	321.5
1996	35	27	--	--	--	--
1997	36.5	19	--	--	--	--
1998	58	39.5	--	--	--	--
1999	27	31	--	--	--	--
2000	15	12	--	--	--	--
2001	11	12	--	--	--	--
2002	16.5	12	--	--	--	--
2003	17	6	--	--	--	--
2004	23	8.5	--	--	--	--
2005	28	12.5	--	--	--	--
2006	25	23	_	_	--	_
2007	24	28	_	_	--	_
2008	34	37	_	_	--	--
2009[2]	29	29	29.2	23.1	17.9	70.6
2010	22.5	22	--	--	--	--
2011	--	--	--	--	--	--
2012	--	--	--	--	--	--
2013	--	--	--	--	--	--
2014	63	54	--	--	--	--
2015	44	42	--	--	--	--
2016[3]	22	16	31.8	22.1	11.1	65.0
2017	36	24	--	--	--	--
2018	52	23	--	--	--	--
2019	38	35	--	--	--	--

[1] Creel survey from mid-April thru late October 1968, 1969, 1970
[2] Creel survey from May 15, 2009 thru May 30, 2010
[3] Creel survey from May 1, 2016 thru March 31, 2017

Table 11. Lake Trout gill net catch (fish/net-night) by stretch mesh size collected from Payette Lake from summer through fall 2019. Catch rates are shown also for 2018, only for mesh sizes used in both years.

Mesh size (mm)	Nights[1]	Fish caught	CPUE/night
	2019		
38	179	119	0.66
51	179	371	2.07
64	179	294	1.64
Total	537	784	1.46
	2018		
51	18	102	5.67
64	24	115	4.79
Total	42	217	5.17

[1] A net-night is for 91.5 m of net.

Table 12. Payette Lake kokanee salmon spawner counts and estimated spawning run size and biomass from 1988 through 2017 in the North Fork Payette River.

Year	Peak count	Estimated spawner numbers	Number/lake ha[1]	Average spawner weight (g)	Average spawner TL (mm)
1988	13,200	22,800	13.3	346	--
1989	8,400	14,500	8.4	349	--
1990	9,642	16,700	9.7	358	--
1991	10,400	18,000	10.5	505	365
1992	16,945	29,300	17.1	377	
1993[a]	34,994	59,310	34.6	245	--
1994	25,550	44,200	25.8	214	--
1995	32,050	55,450	32.3	147	260
1996	35,090	60,707	35.4	162[c]	--
1997	36,300[e]	64,891[d]	37.8	148	265
1998	14,585	25,232	14.7	143	254
1999	15,590	26,971	15.7	184	276
2000	15,520	26,850	15.6	188	286
2001[f]	15,690[g]	30,144	17.6	250[b]	--
2002	9,430	16,314	9.5	--	--
2003	5,430	9,394	5.5	279	--
2004	11,290	19,532	11.4	--	--
2005	11,780	20,780	12.1	--	--
2006	5,580	9,650	5.6	--	317
2007	3,925	6,790	4.0	401	340
2008	2,425	4,195	2.4	--	336
2009	1,290	2,232	1.3	--	405
2010	610	1,055	0.6	--	416
2011	435	753	0.4	--	390
2012	852	1,475	0.8	--	376/440[h]
2013	304	526	0.3	--	384/458[h]
2014	245	424	0.3	--	-
2015	185	320	0.2	--	455
2016	364	630	0.4	--	404
2017	583	1,008	0.6	--	383/451[h]
2018	420	727	0.4	--	442/519[h]
2019	1,955	3,382	2.0	--	424

[1] 1,717 ha usable kokanee habitat in Payette Lake (Area with depth greater than 40 feet).
[a] Estimate made from stream and weir counts (Frost and Bennett, 1994)
[b] From gill net data of captured spawners in Payette Lake during lake survey.
[c] From trawling collections made in September 1996.
[d] Includes 2,092 fish spawned and removed by Nampa Fish Hatchery.
[e] Does not include 2,092 fish spawned and removed by Nampa Fish Hatchery.
[f] Includes 3,000 fish spawned and removed by Nampa Fish Hatchery.
[g] Does not include 3,000 fish spawned and removed by Nampa Fish Hatchery.
[h] Two distinct age classes.

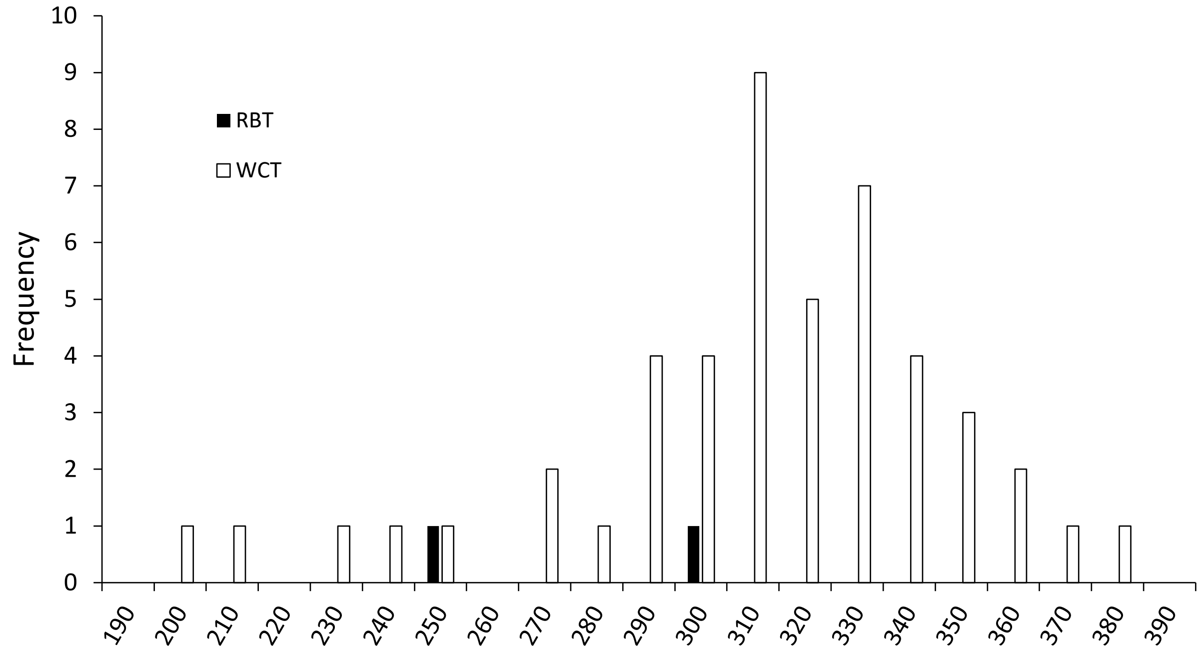


Figure 1. Length-frequency histogram of Rainbow Trout (RBT) and Westslope Cutthroat Trout (WCT) caught during gill netting and angling surveys at Cly Lake #3-4 in 2019.

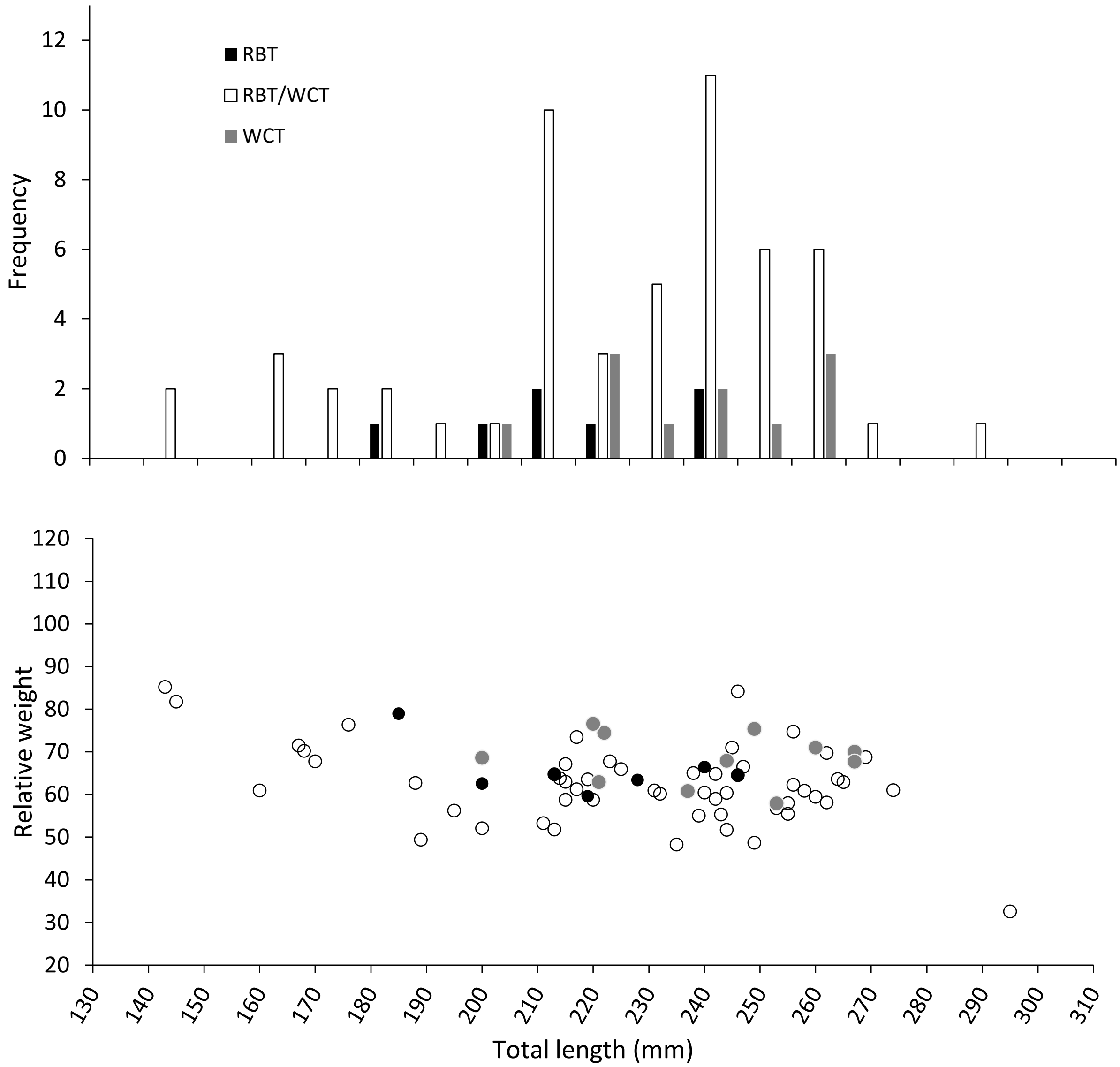


Figure 2. Length-frequency histogram and relative weight of Rainbow Trout (RBT), Rainbow Trout X Westslope Cutthroat hybrids (RBT/WCT), and Westslope Cutthroat Trout (WCT) caught during angling surveys at Crater Lake #1 in 2019.

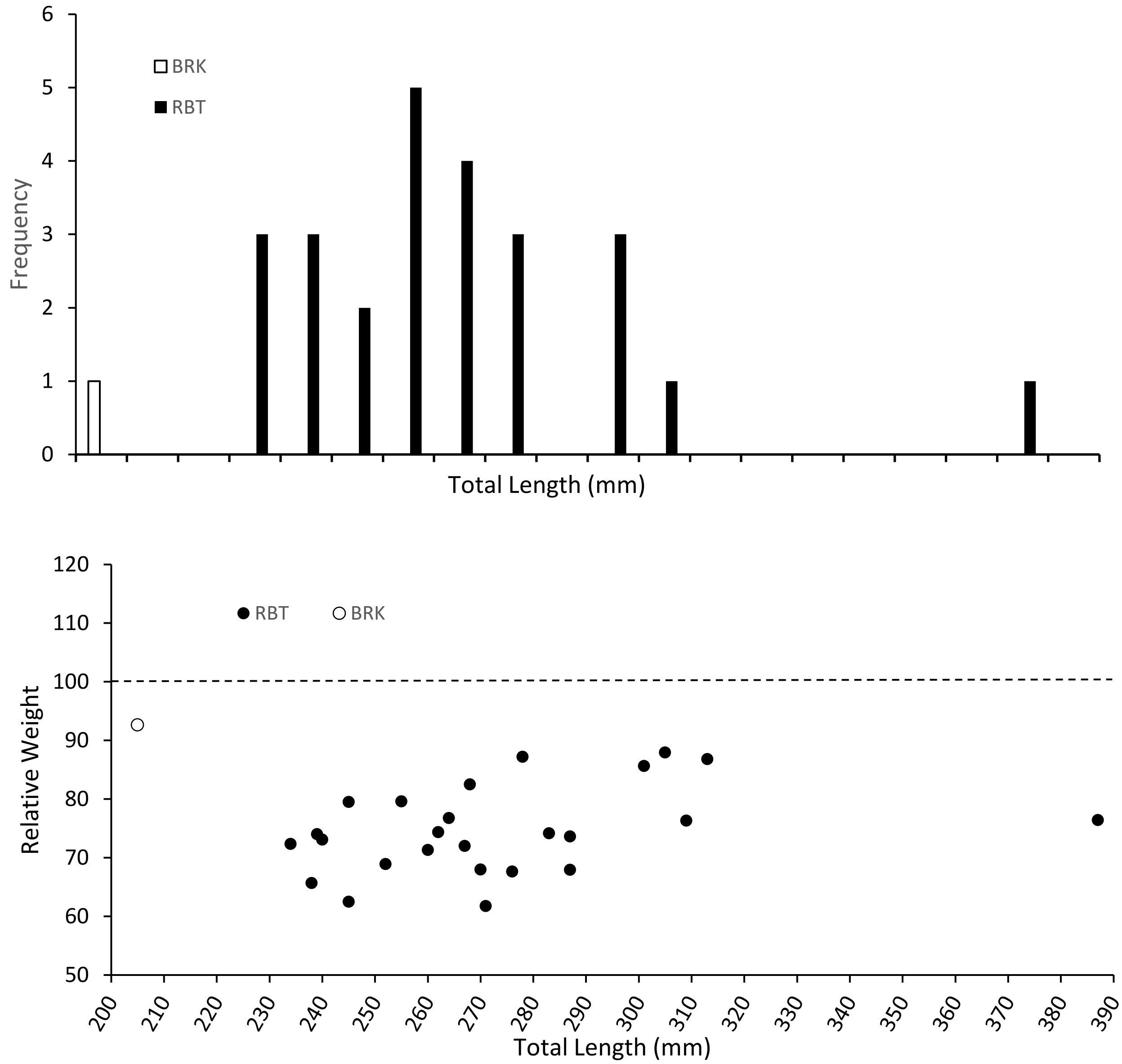


Figure 3. Length-frequency histogram and relative weight of Rainbow Trout (RBT; *n* = 25) and Brook Trout (BRK; *n* = 1) collected during gill netting at Granite Reservoir in 2019.

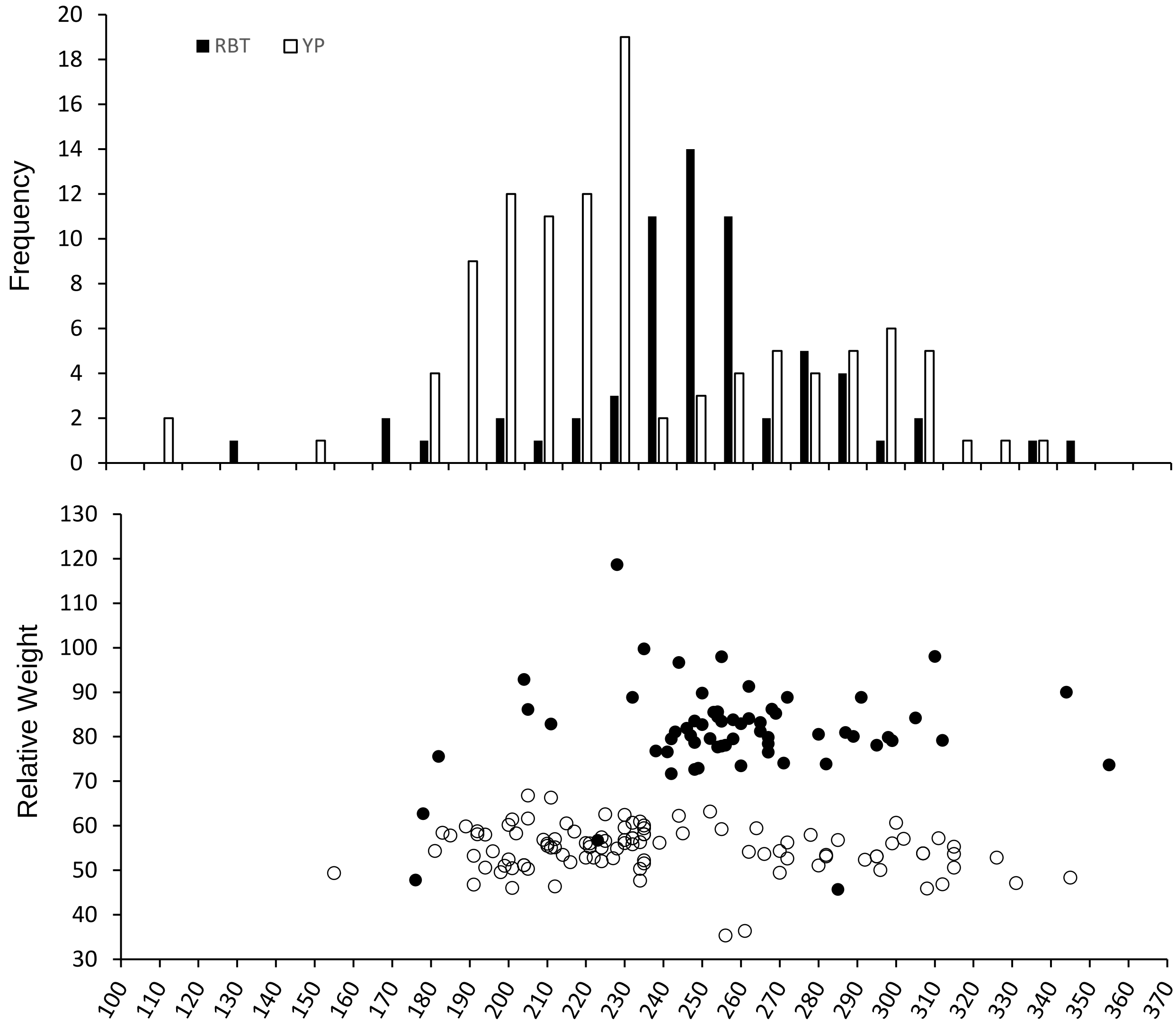


Figure 4. Length-frequency histogram and relative weights of Rainbow Trout (RBT; *n* = 62) and Yellow Perch (YP; *n* = 105) collected during gill netting at Herrick Reservoir in 2019. Weights were not available for three fish.

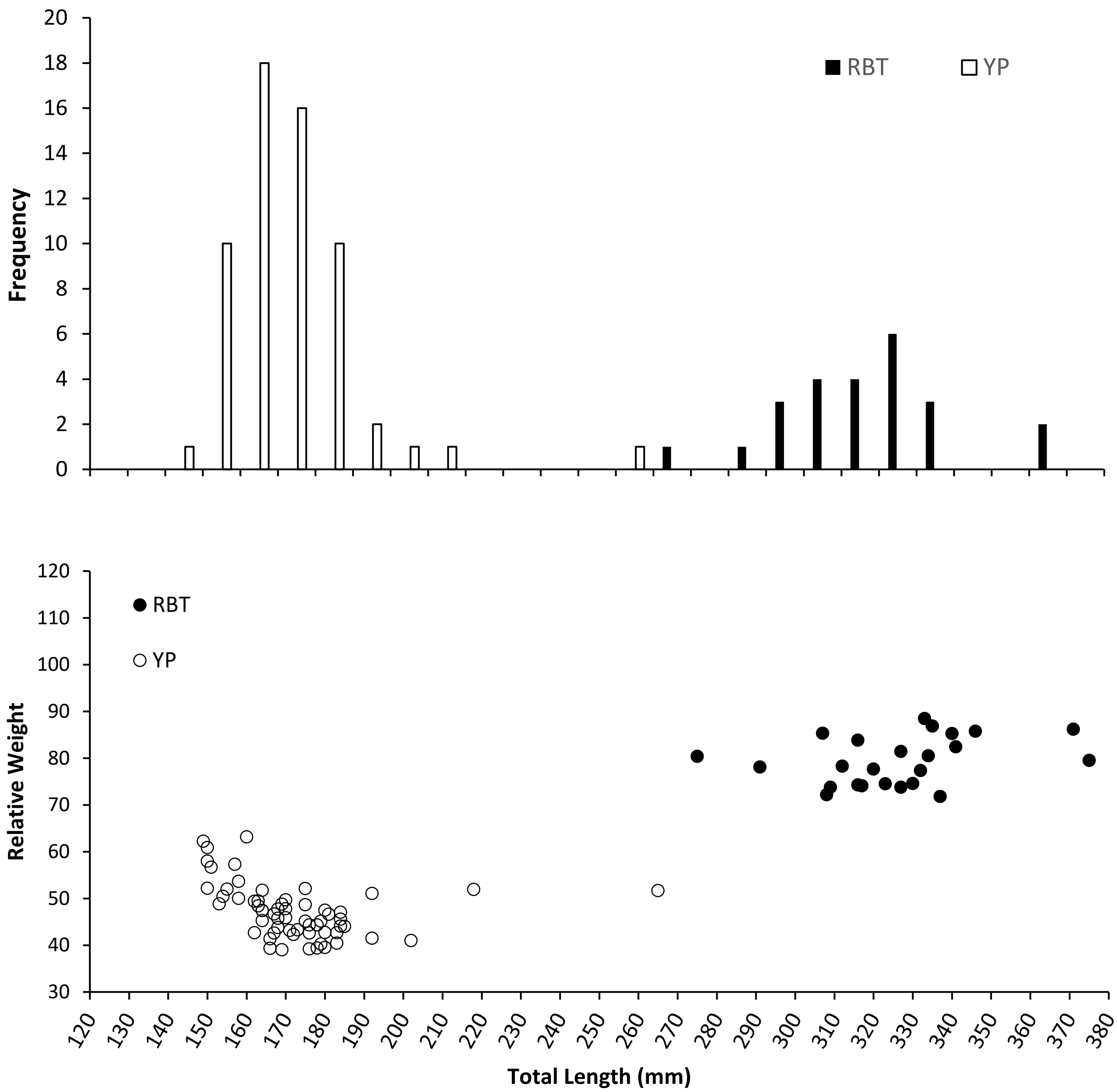
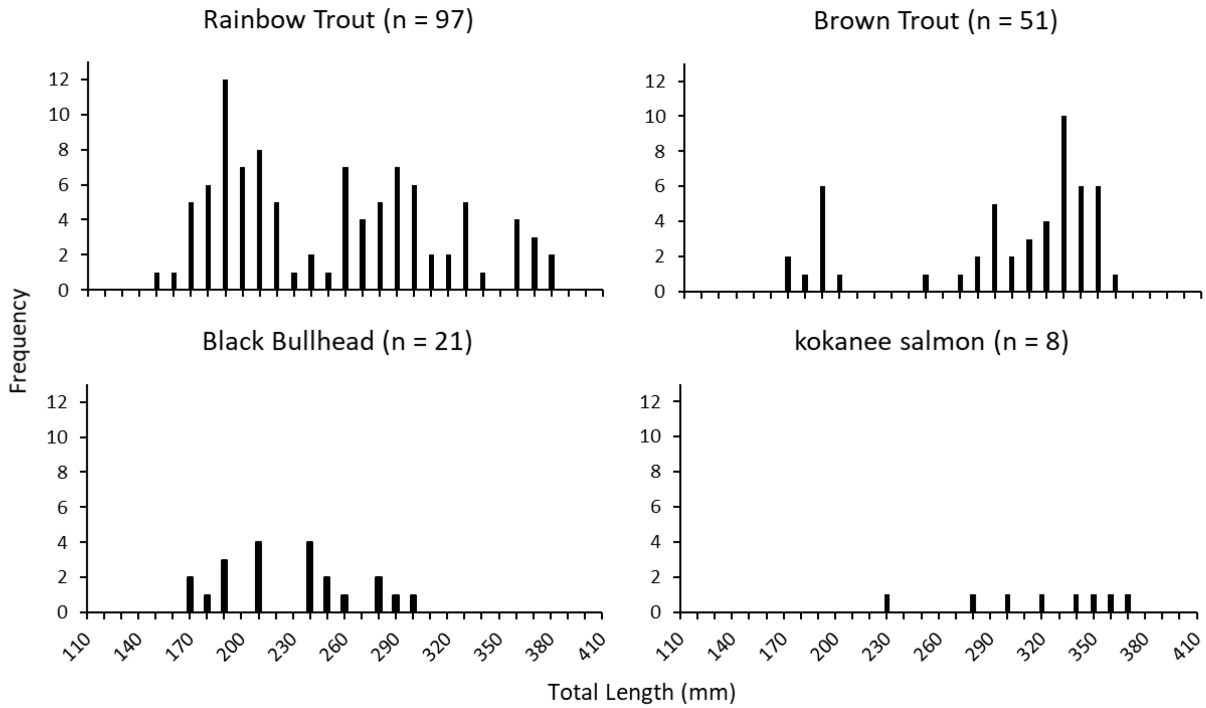


Figure 5. Length-frequency histogram and relative weights of Rainbow Trout (RBT; *n* = 21) and Yellow Perch (YP; *n* = 60) collected during gill netting at Lost Valley Reservoir in 2019.



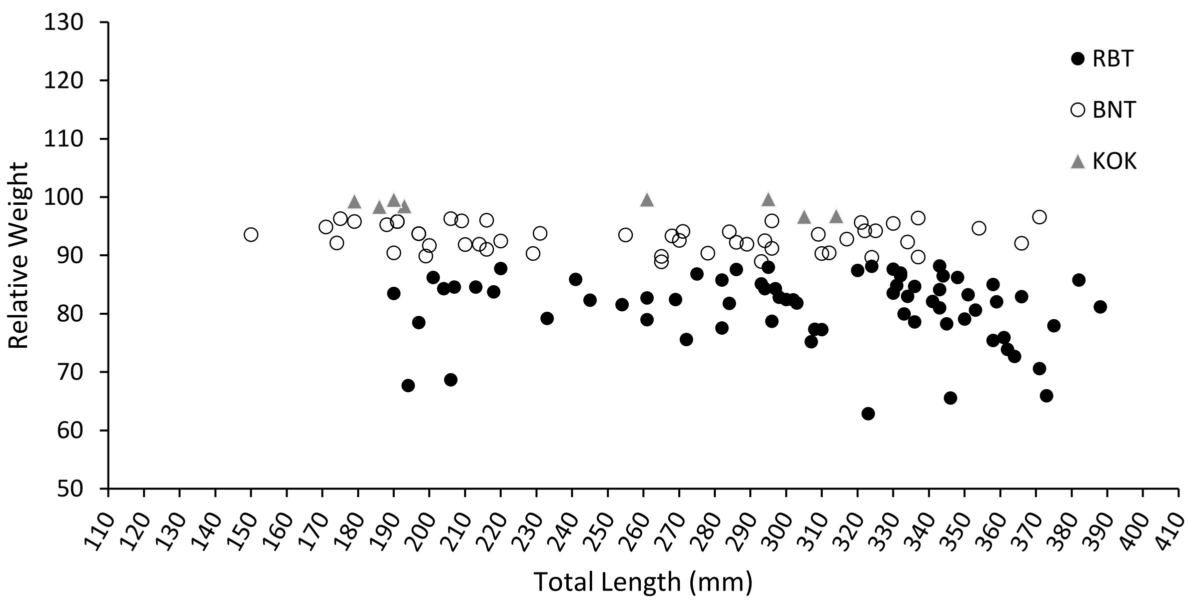


Figure 6. Length-frequency histogram and relative weight of Rainbow Trout, Black Bullhead, Brown Trout, and kokanee salmon collected during gill netting at Horsethief Reservoir in 2019. Relative weights are not included for Black Bullhead.

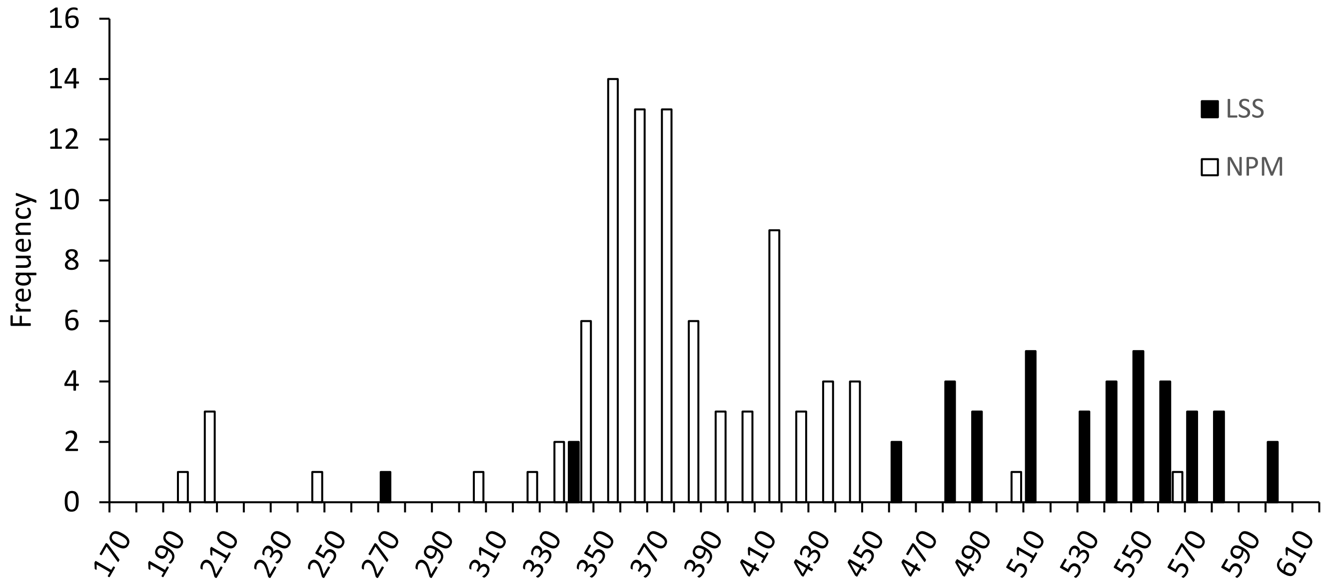


Figure 7. Length-frequency histogram of Large Scale Sucker (*n* = 37), Northern Pikeminnow (*n* = 66) collected during gill netting at Little Payette Lake in 2019.

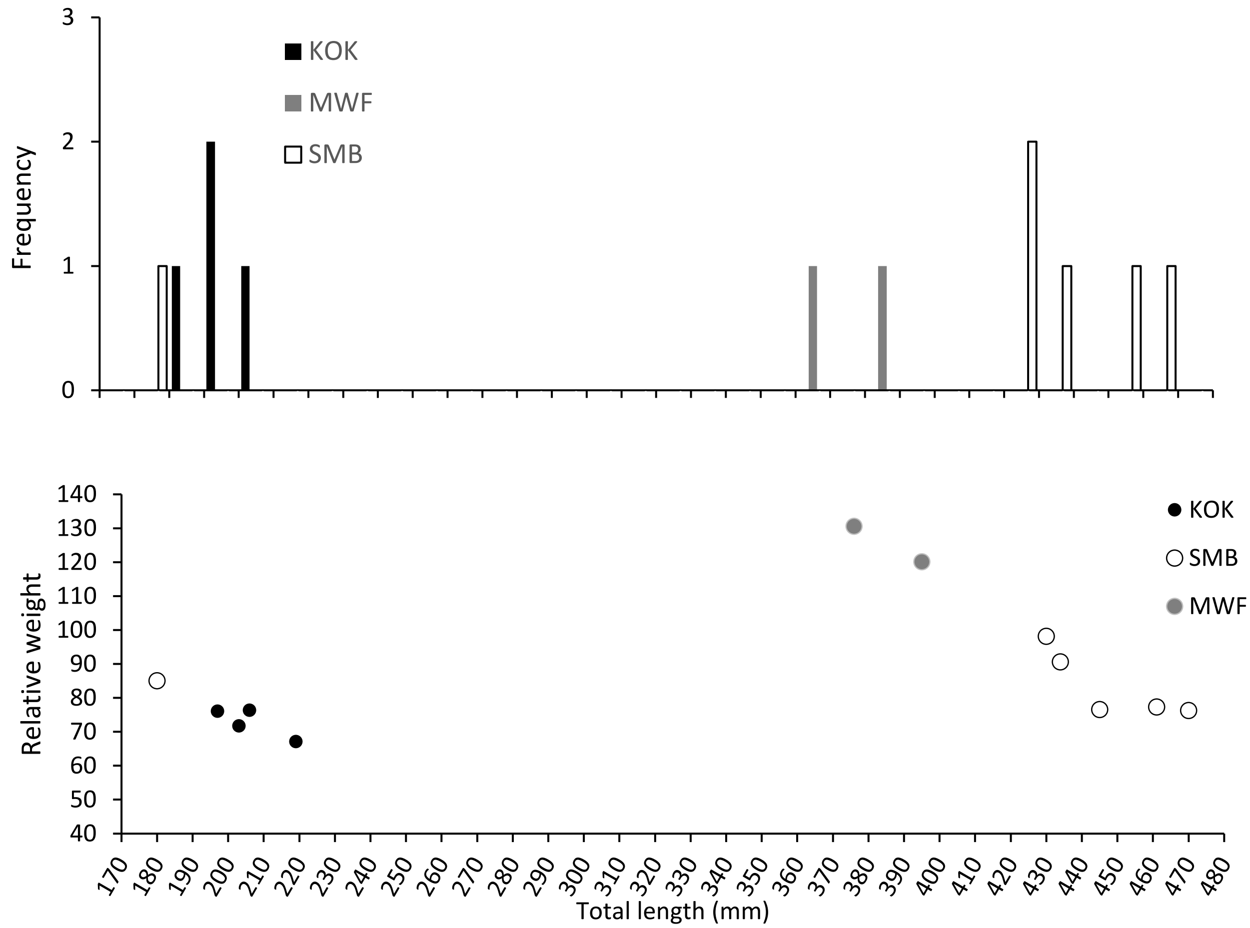


Figure 8. Length-frequency histogram and relative weight of kokanee salmon (n = 4), Mountain Whitefish (n = 2), and Smallmouth Bass (n = 6) collected during gill netting at Little Payette Lake in 2019.

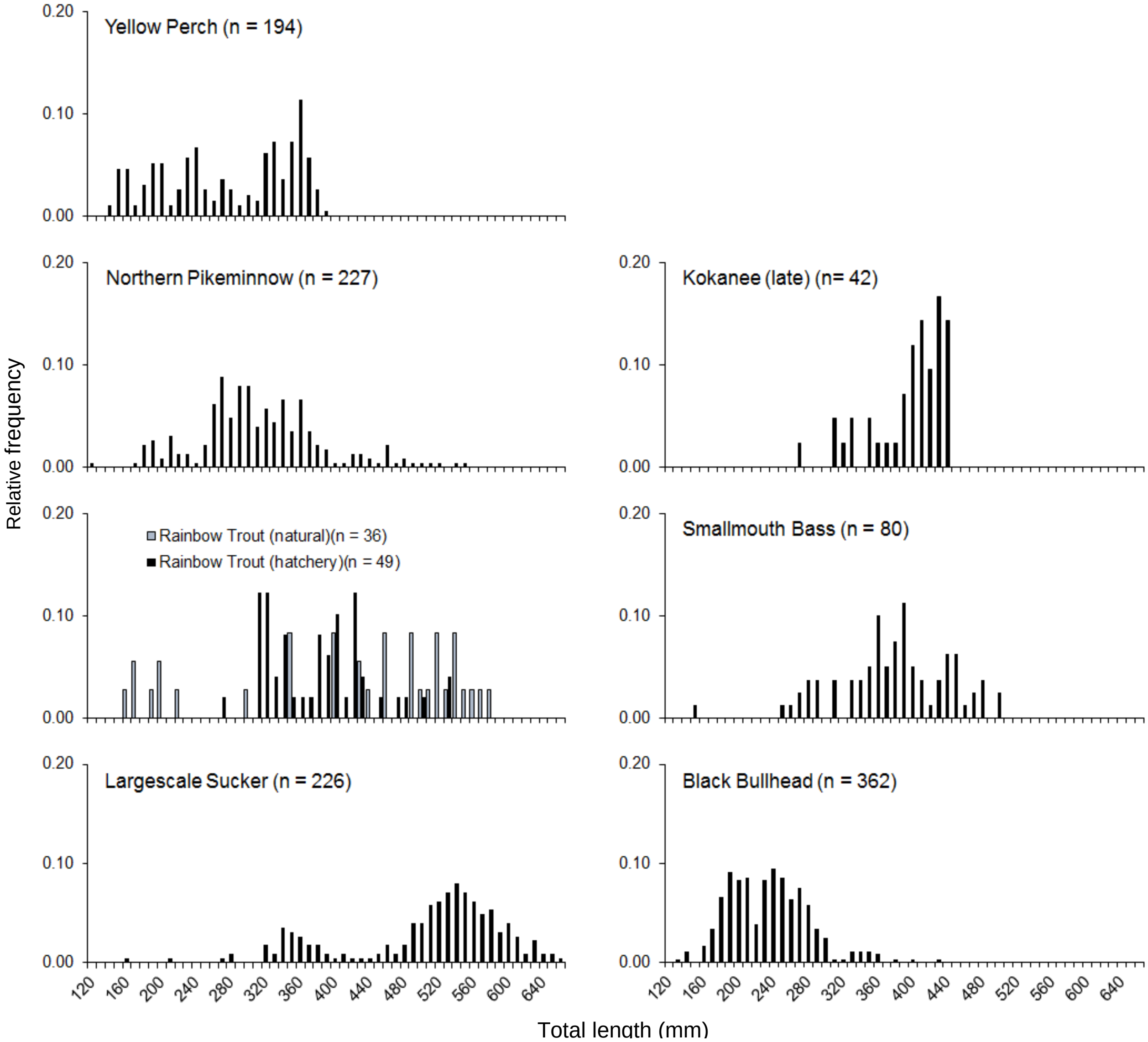


Figure 9. Relative-frequency by species of fish collected with gill nets in Lake Cascade in October 2019.

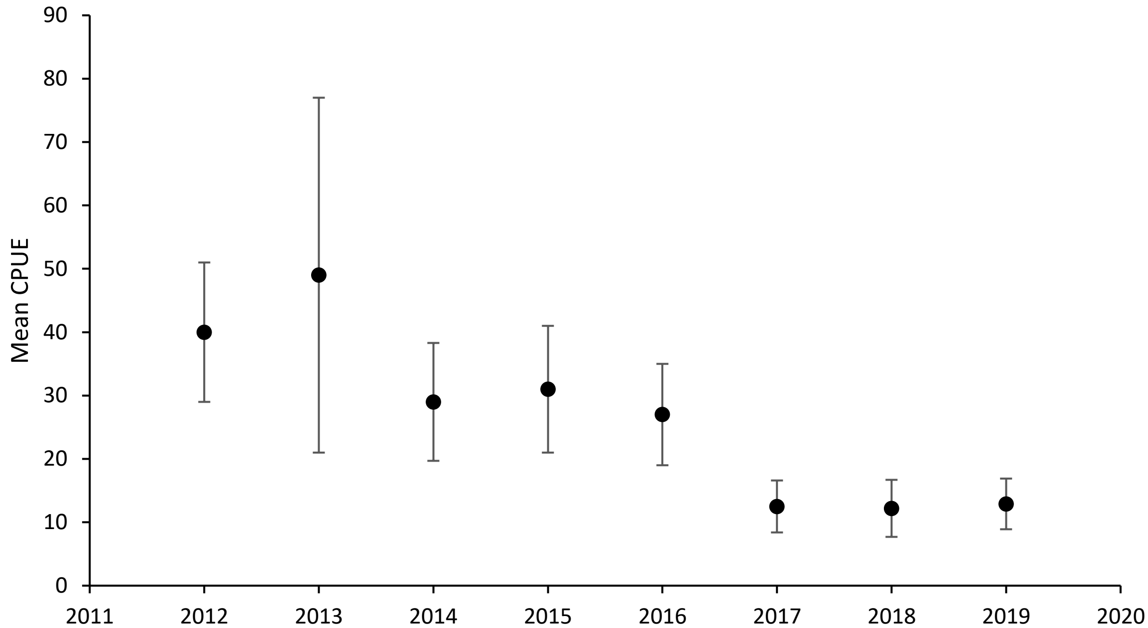


Figure 10. Mean catch-per-unit-effort (CPUE) with 90% confidence intervals of all Yellow Perch collected with gillnets in Lake Cascade in October 2012 through 2019.

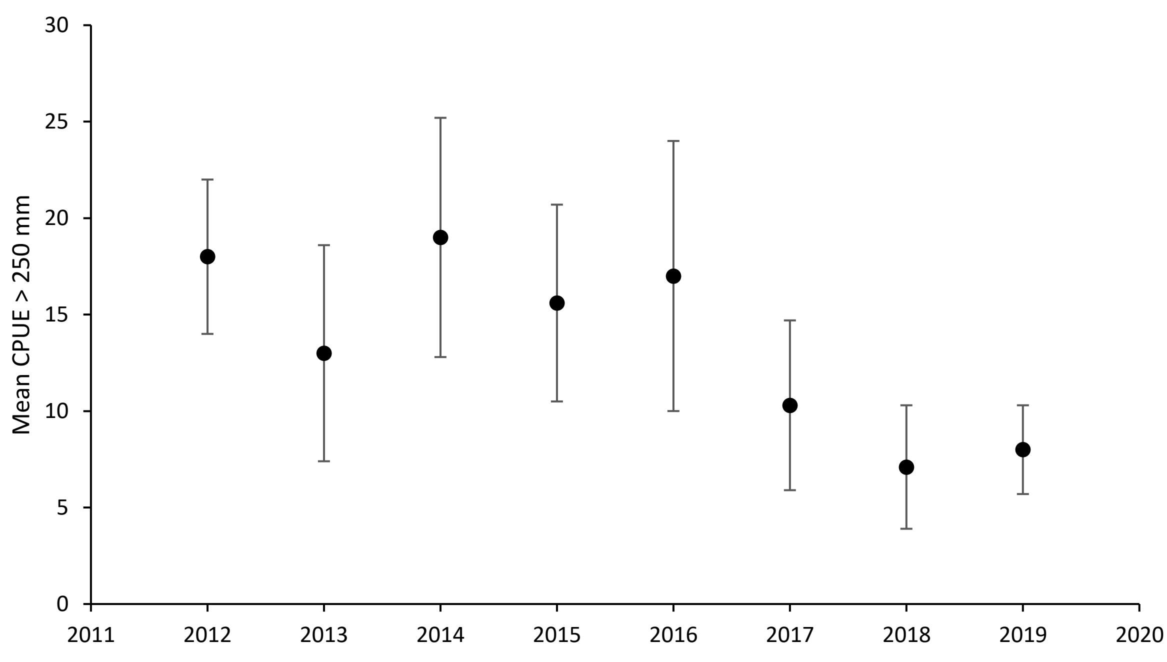


Figure 11. Mean catch-per-unit-effort (CPUE) with 90% confidence intervals of Yellow Perch greater than 250 mm collected with gillnets in Lake Cascade in October 2012 through 2019.

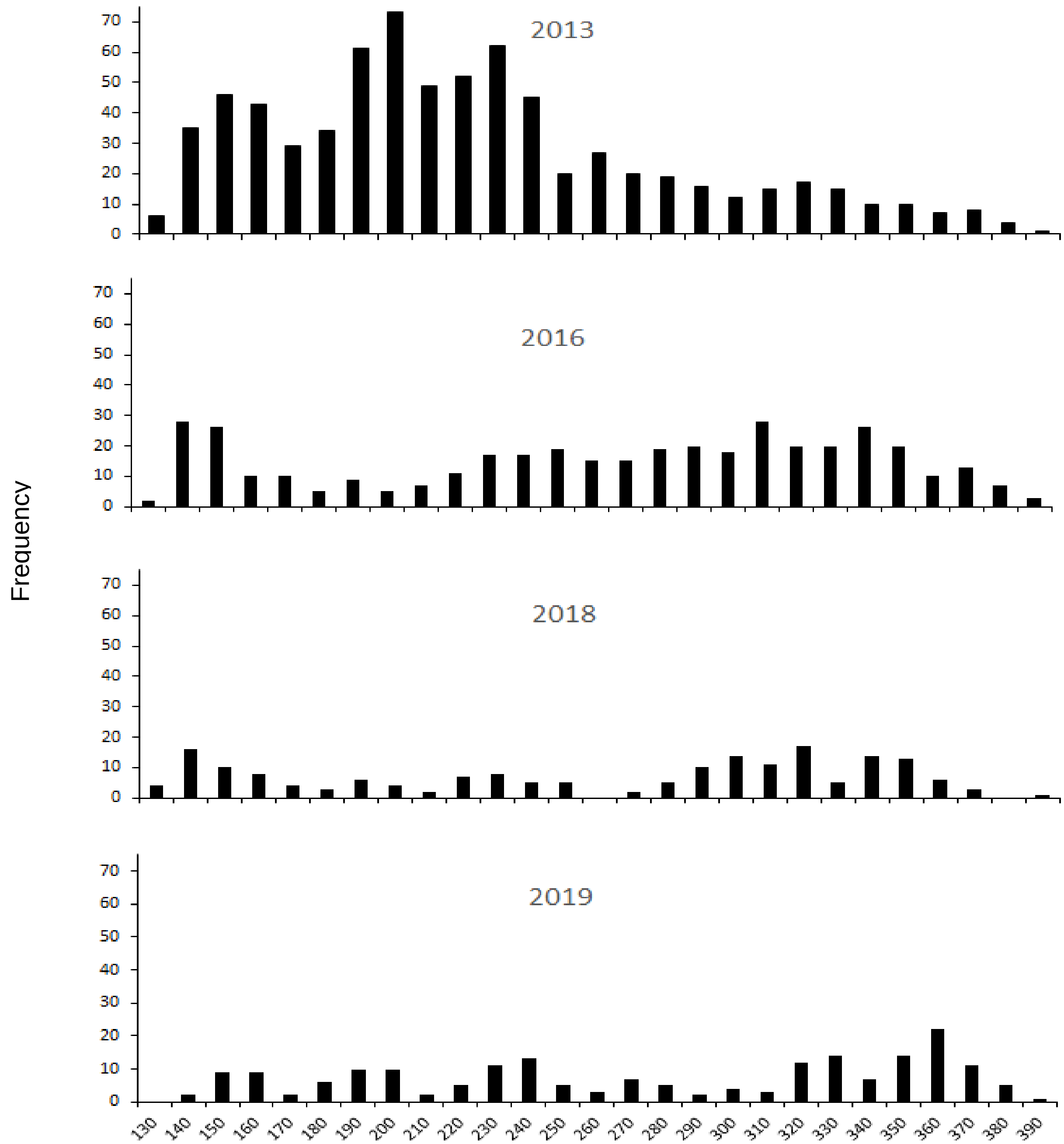


Figure 12. Length-frequency histograms of Yellow Perch collected with gill nets in Lake Cascade in October 2013, 2016, 2018 and 2019.

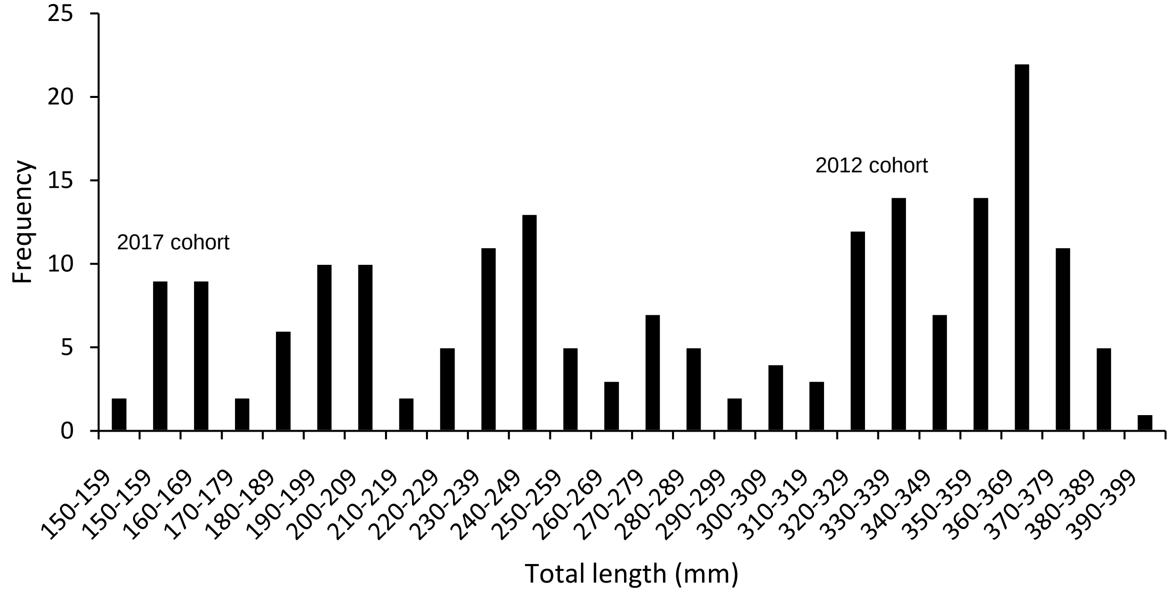


Figure 13. Length-frequency histogram with estimated ages of Yellow Perch collected with gill nets in Lake Cascade in October 2019

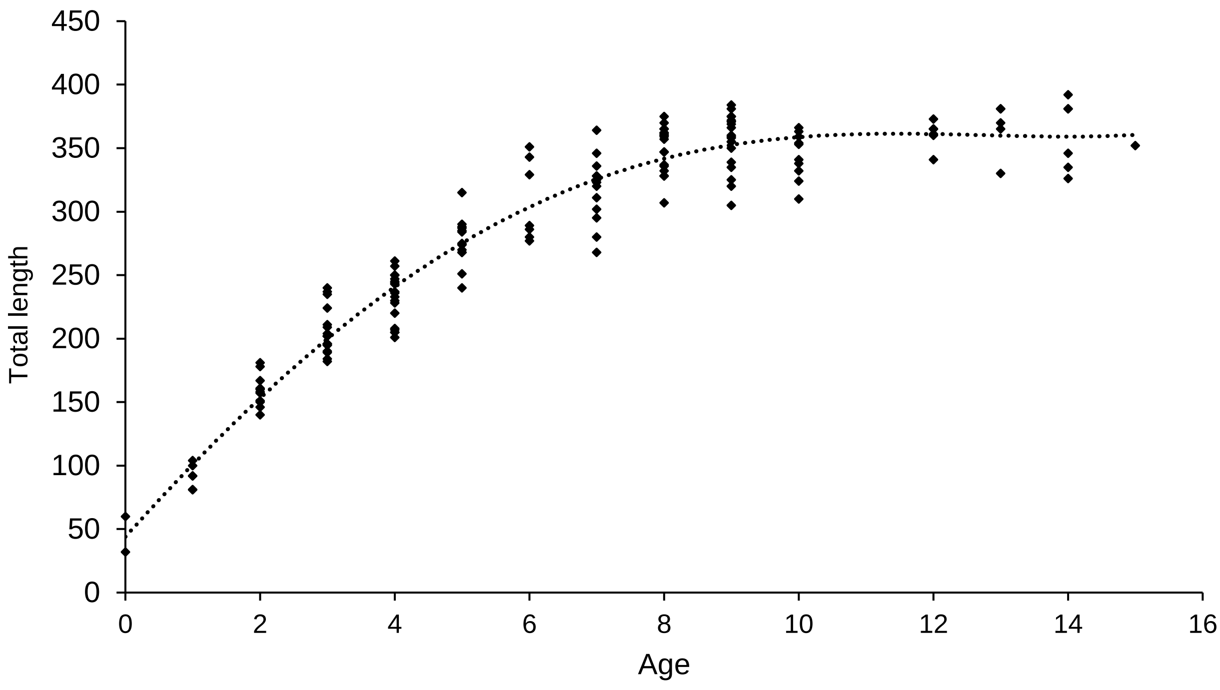


Figure 14. Length-at-age at time of capture for Yellow Perch collected with gill nets in Lake Cascade in October 2019.

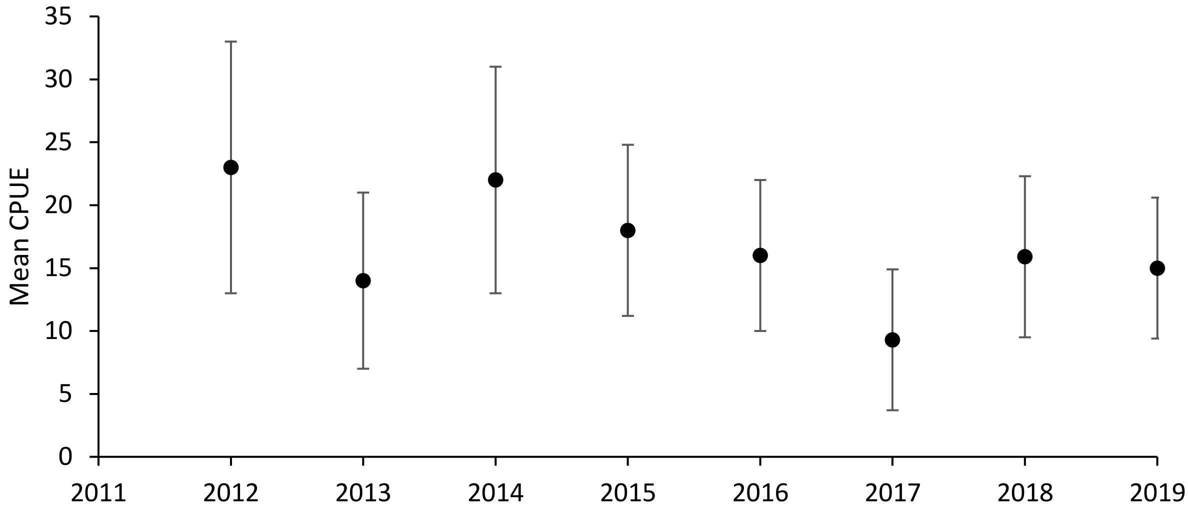


Figure 15. Mean CPUE with 90% confidence intervals of all Northern Pikeminnow collected with gillnets in Lake Cascade in October 2012 through 2019.

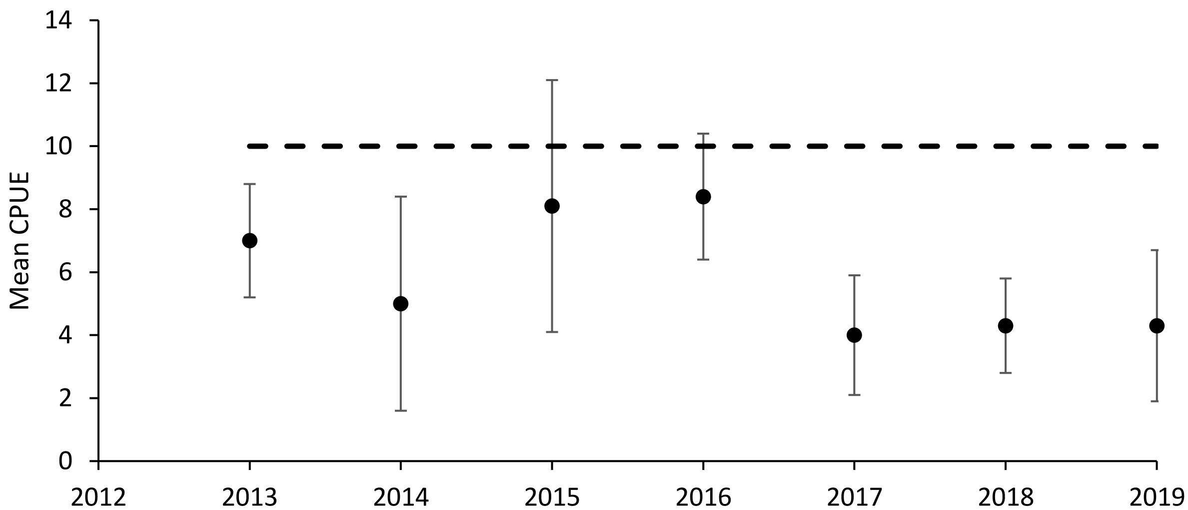


Figure 16. Mean catch-per-unit-effort (CPUE) with 90% confidence intervals of Northern Pikeminnow greater than 350 mm collected with gillnets in Lake Cascade in October 2012 through 2019. Dashed line shows threshold (mean CPUE = 10) outlined in statewide fisheries management plan (2019-2024).

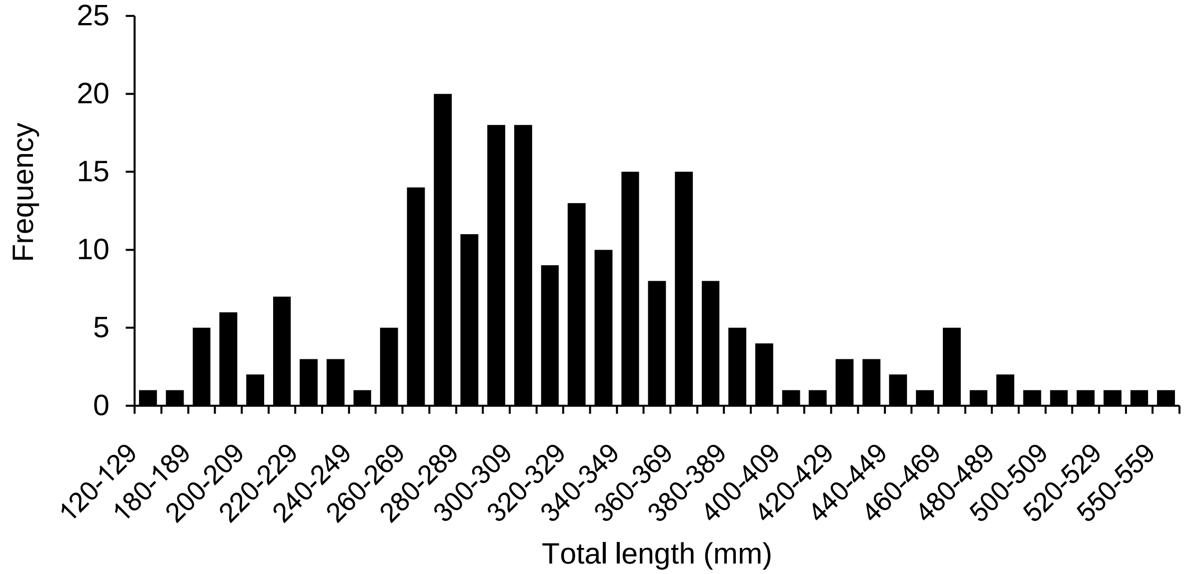


Figure 17. Length-frequency histogram for Northern Pikeminnow (*n* = 227) collected with gill nets in Lake Cascade in October 2019.

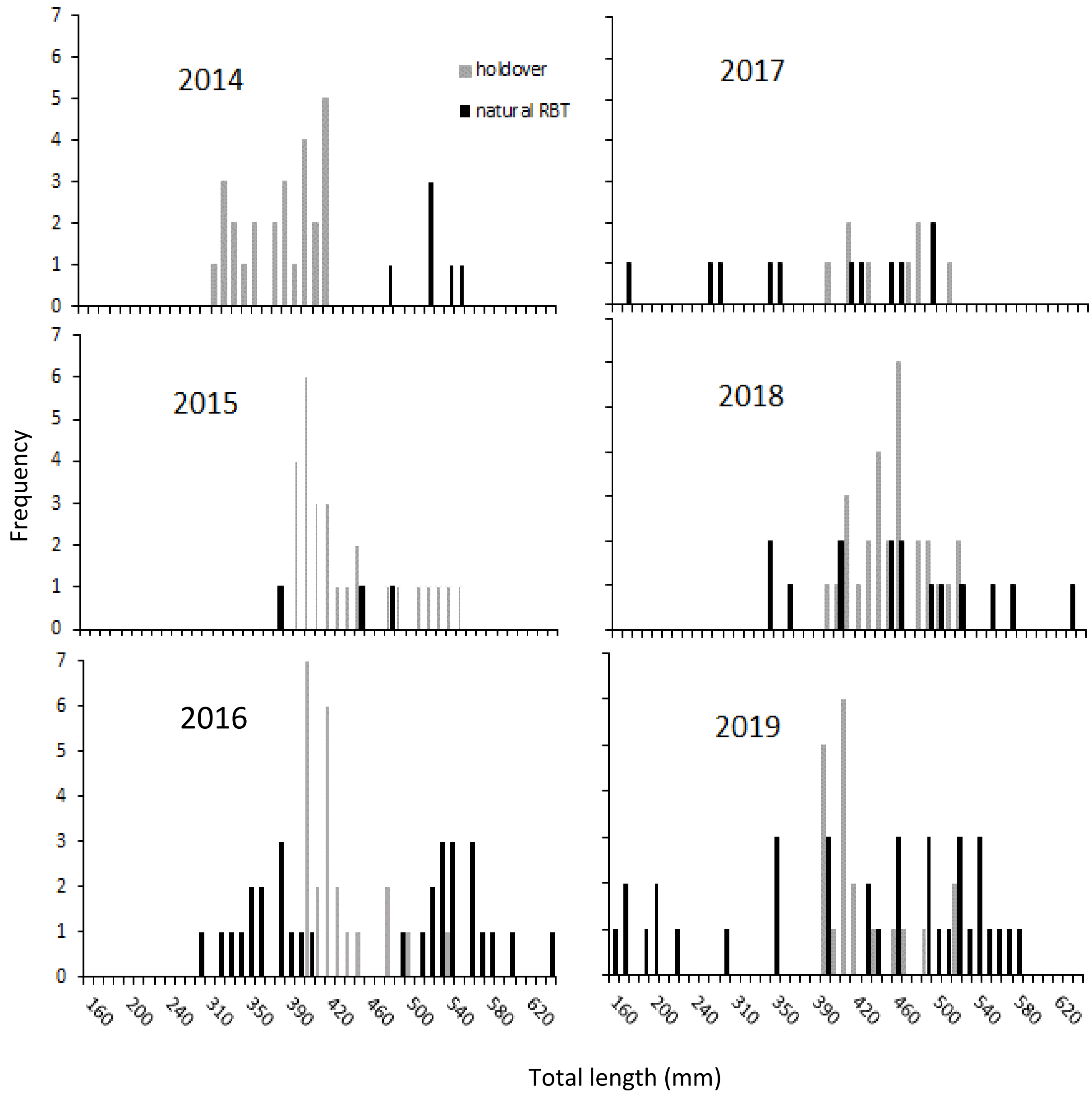


Figure 18. Length-frequency histograms of hatchery holdover (>399 mm) and natural-origin Rainbow Trout collected with gillnets in Lake Cascade in October 2014 through 2019.

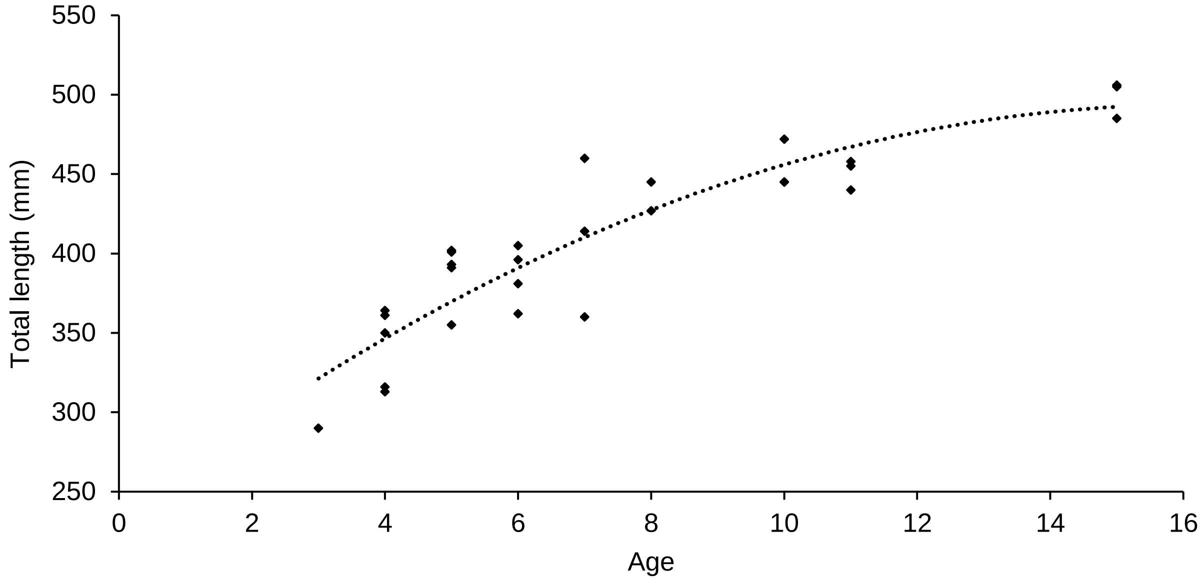


Figure 19. Length-at-age at time of capture for Smallmouth Bass collected with gill nets in Lake Cascade in October 2019. Ages estimated using fish operculums.

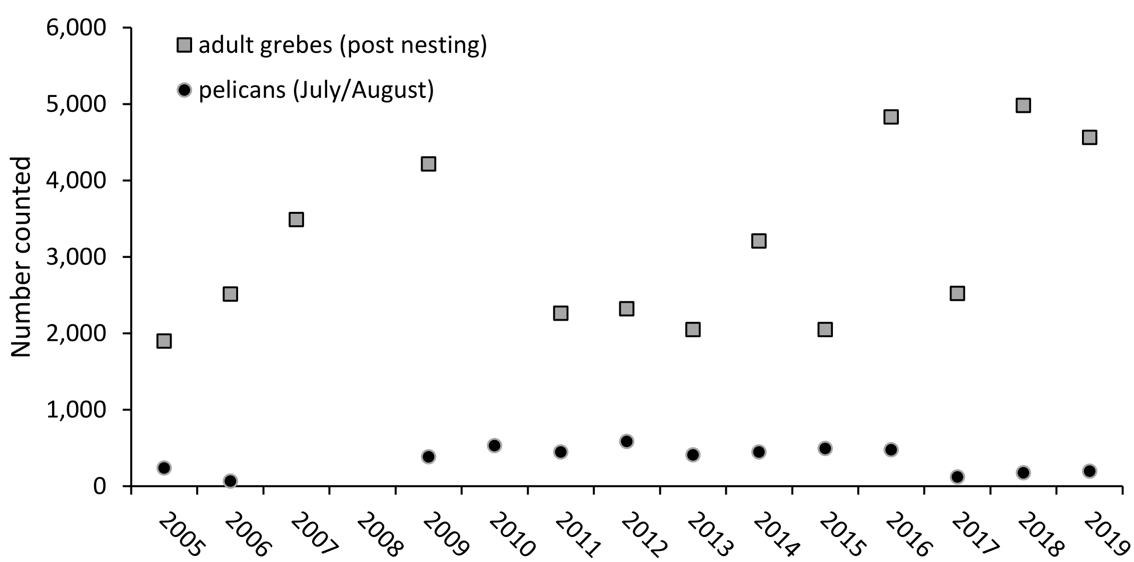


Figure 20. Adult Western Grebe (*Aechmophorus occidentalis*) and American White Pelican counts on Lake Cascade from 2004 through 2019 (IDFG McCall subregion, unpublished data).

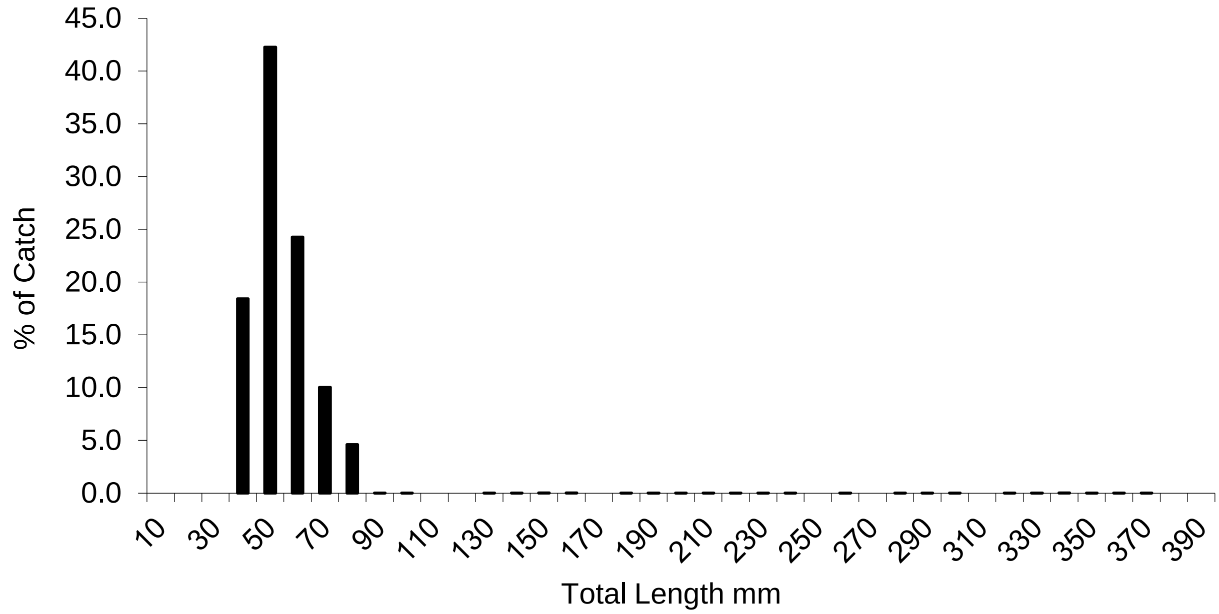


Figure 21. Percent of catch by length of Yellow Perch captured with a bottom trawl in Lake Cascade in October 2019.

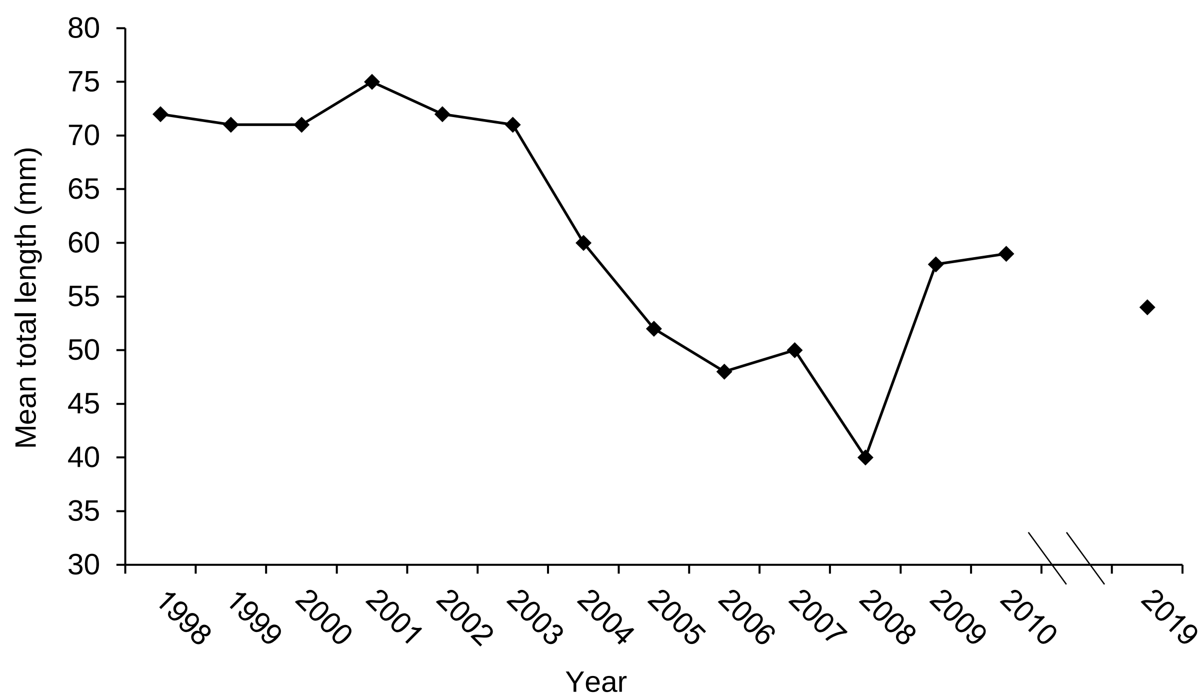


Figure 22. Mean total length of age 0+ Yellow Perch captured with a bottom trawl in Lake Cascade in October 1998 through 2010, and 2019.

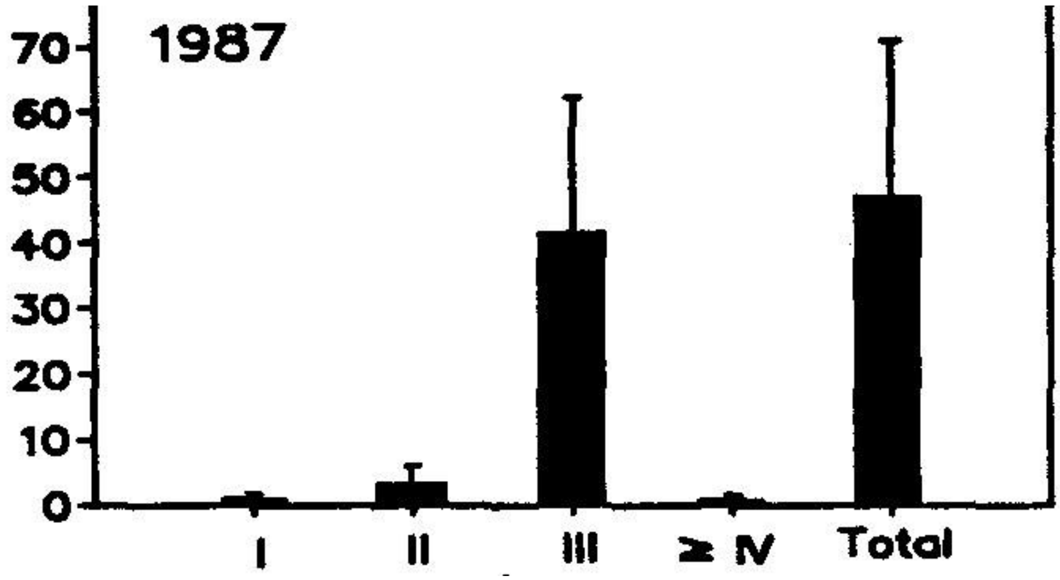


Figure 23. Number of Yellow Perch by age captured with bottom trawl in Lake Cascade in 1987.

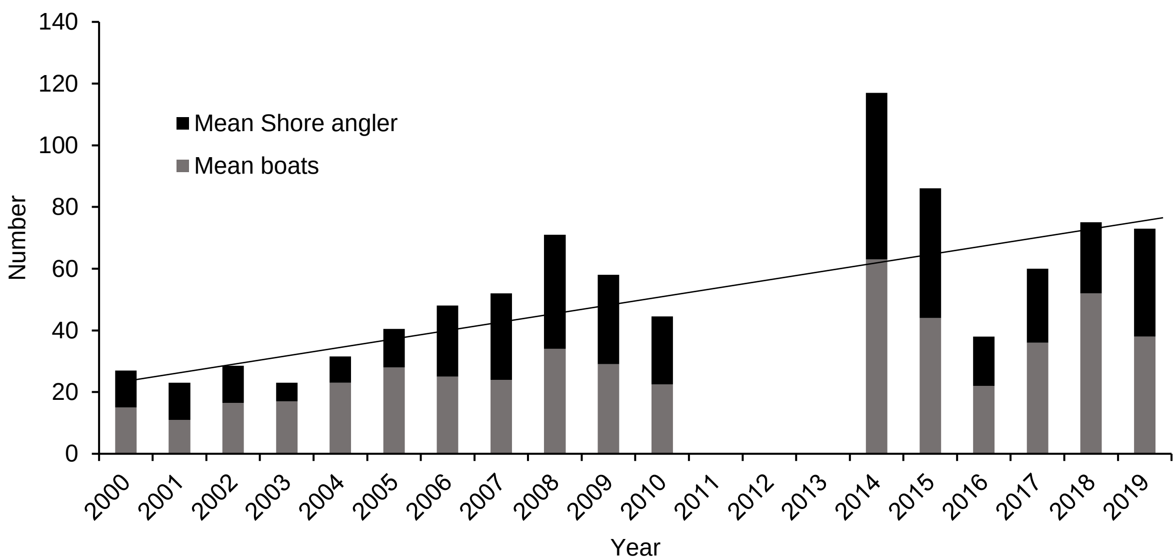


Figure 24. Mean index count of shore anglers and number of fishing boats on Lake Cascade on Memorial Day, Independence Day, and Labor Day, 2000 through 2019.

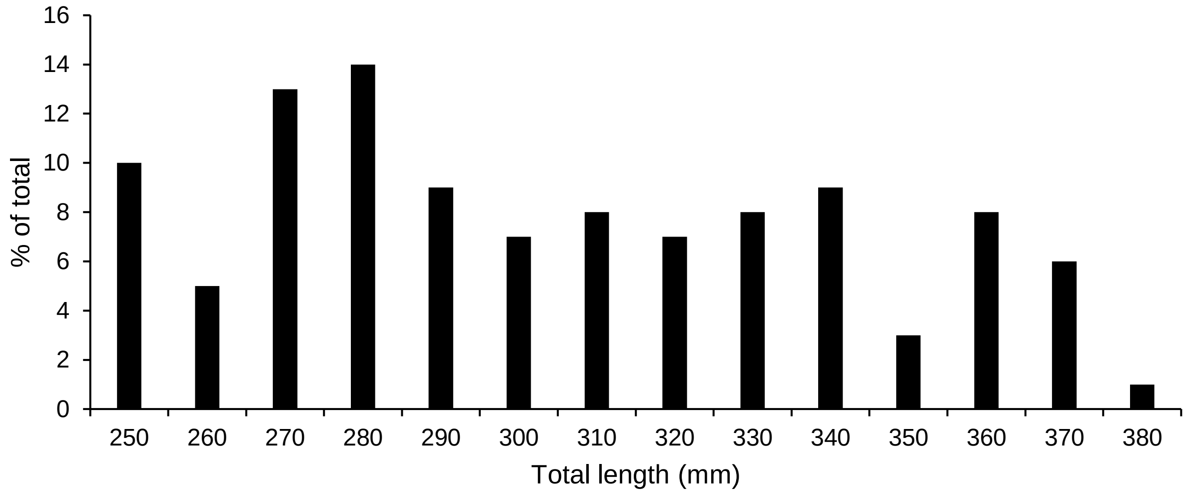


Figure 25. Percent of Yellow Perch tagged by 10-mm length groups collected with trap nets in Lake Cascade in May 2019.

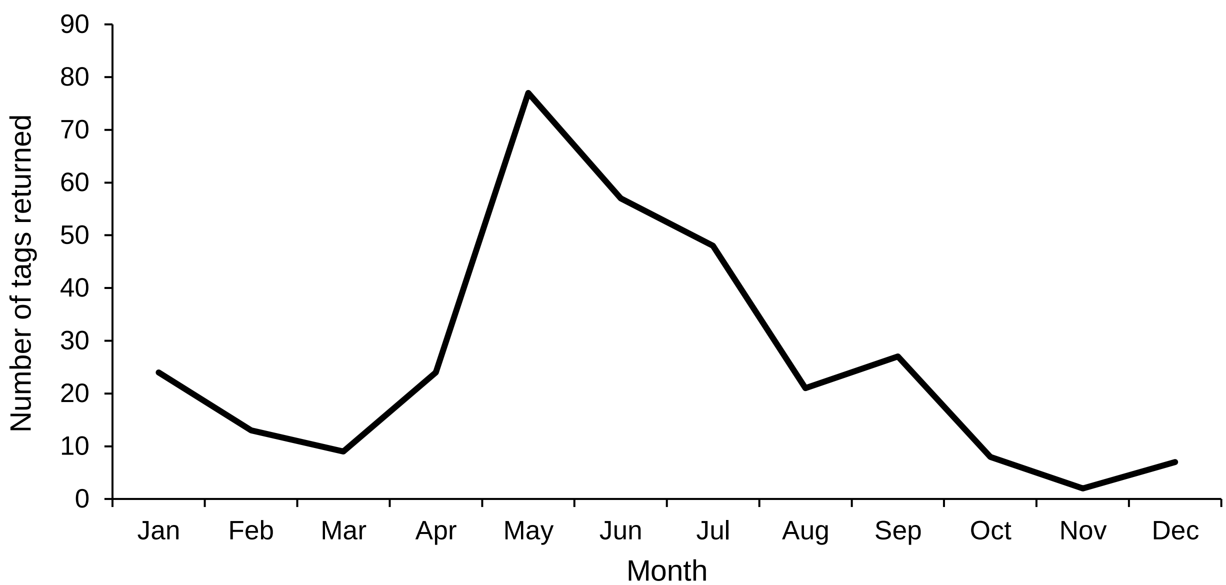


Figure 26. Total count of Yellow Perch tags returns by anglers by month from Lake Cascade for fish tagged in 2009, 2013, 2015, 2018, and 2019 combined.

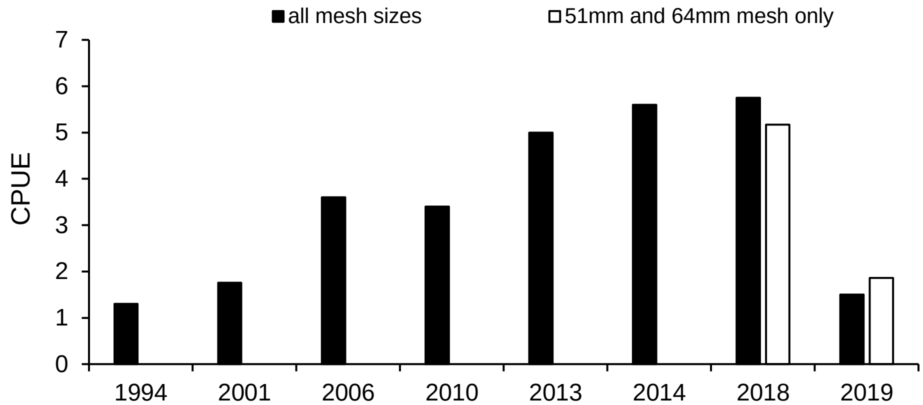


Figure 27. Lake Trout catch-per-unit-effort (CPUE; fish per 91.5m net-night) in Payette Lake, 1994 through 2019, for all mesh sizes and comparison for mesh sizes used in both 2018 and 2019.

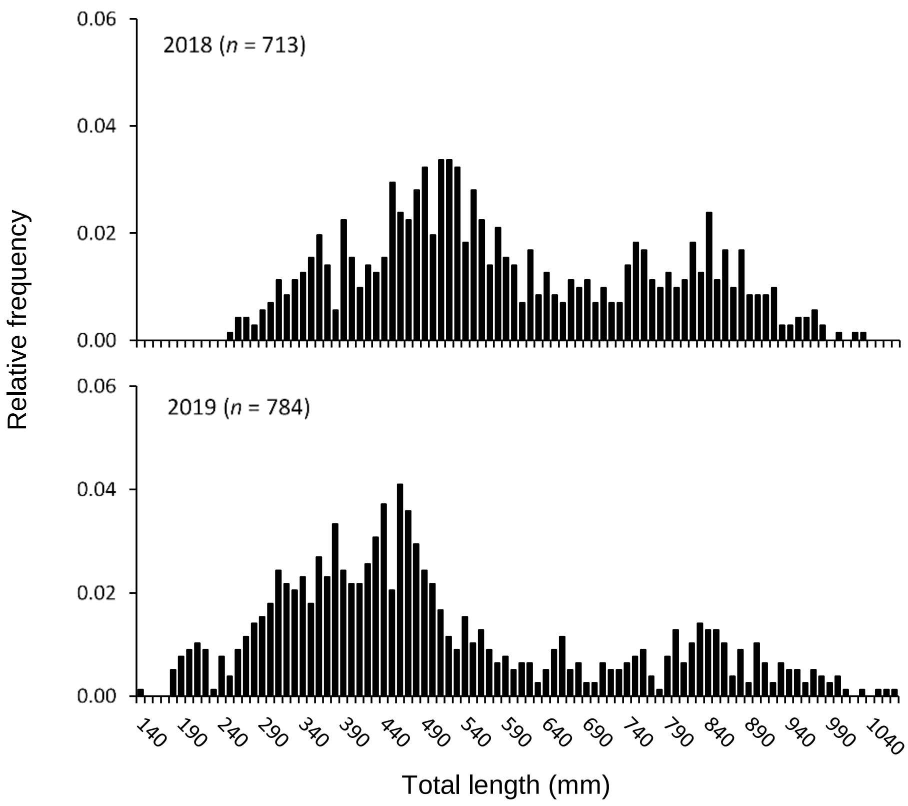


Figure 28. Length-frequency histogram for all Lake Trout captured in Payette Lake in 2018 and 2019. Note: different mesh sizes were used between years.

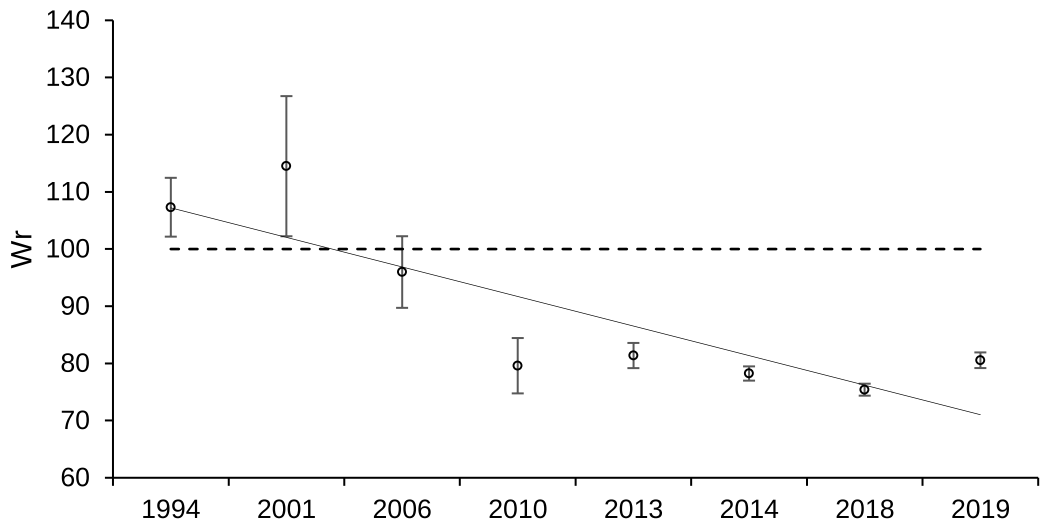


Figure 29. Mean relative weights (±95% confidence intervals) for Lake Trout (> 400mm TL) captured in Payette Lake, 1994 through 2019. Dashed line represents a relative weight of 100, for perspective.

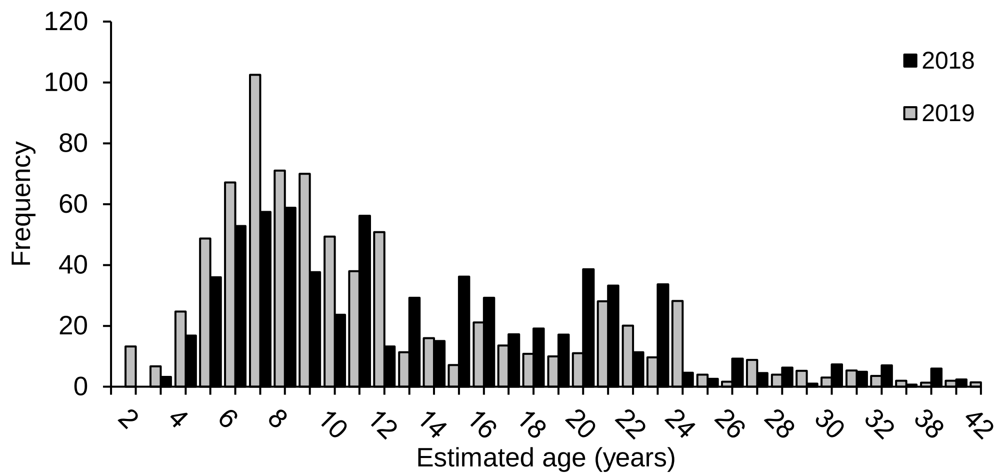


Figure 30. Estimated age-frequency histogram of Lake Trout captured in Payette Lake in 2018 and 2019.

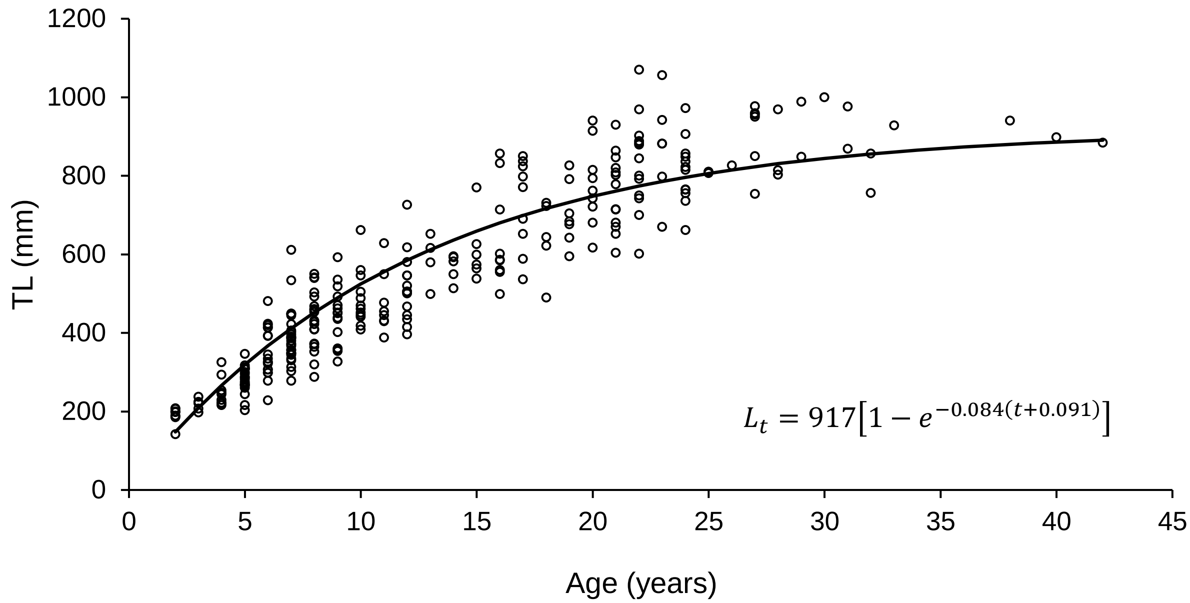


Figure 31. Von Bertalanffy growth curve for Lake Trout in Payette Lake, based on back-calculated length-at-age data collected in 2019. Curve is plotted against length-at-age at capture for all Lake Trout aged in 2019

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